G. G. Turner

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THE TREATMENT OF INJURIES

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BY FRICTION AND MOVEMENT

BY

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CHAPTER I.

INTRODUCTORY AND PERSONAL.

The circumstances which first directed my attention towards the department of surgery which deals mainly with the treatment of injuries, and especially with that of injuries self-inflicted in the course of inordinate muscular exertion, may not unreasonably, in view of the criticisms which have been somewhat freely bestowed upon methods which have been beneficial in my hands, be held to call for a certain amount of detailed explanation. I began my professional life in partnership with my father, the late Dr. Peter Hood, who for many years conducted one of the largest general practices in London, and in whose footsteps it was originally my intention to follow. My father

chanced to have among his patients the then famous "bone-setter," Mr. Hutton (not the person of that name, with whom I was not acquainted, who died about thirteen years ago, and who had some repute of the same kind among his contemporaries, but his uncle), who had on many occasions rendered himself famous by the complete and rapid cure of various forms of lameness or other inability which had resisted the methods then commonly in vogue among surgeons; and this Mr. Hutton, after recovery from a severe illness in which my father had attended him, wished to display his gratitude by a disclosure to us of what he described with full conviction as the "secrets of his art." Of this wish I took advantage; and hence enjoyed opportunities of witnessing the methods of treatment which Mr. Hutton employed, and of seeing the nature of the cases in which those methods were successful. Mr. Hutton had received only a plain commercial education, and was entirely unacquainted with anatomy or surgery; but everything which he did was done in strict accordance with certain

traditions which had been handed down, I believe for a very long period, as "secrets" in his family. On looking at his patients and his treatment by the light of professional knowledge, I perceived that the cases in which he was successful were mainly examples of spurious anchylosis following injury or strain which had been treated by prolonged rest; and in which cure was attainable by breaking down adhesions for which effused lymph had apparently furnished the material, and which had formed between parts which had often been left for weeks together in undisturbed repose or in unbroken contact. Such adhesions, as a rule, were not close enough to render movement impossible; but their dragging upon their points of attachment rendered it painful, and the pain thus occasioned was often followed by swelling and so-called "inflammation," in consequence of which the patient was once more condemned to splints and immobility, until the adhesions had recovered from any trifling stretching to which they might have been subjected, and the original condition of

helplessness was restored. Mr. Hutton dealt successfully with many of these cases by rupturing the adhesions by a single wrench or twist, and by enjoining immediate use of the limb; and his "secrets" had reference mainly to certain arts of manipulation by which opposing muscles might be relaxed. The rupture of an adhesion was usually distinctly audible; and Mr. Hutton said, and probably entirely believed, that the sound was indicative of the return of a displaced bone to its proper position. The patient, as a rule, would know as little about the skeleton as Mr. Hutton himself; and it would have been useless to tell either of them that in the position or locality concerned there was no bone to be displaced or to return. The general result of the surgical treatment which then commonly prevailed was that many cases of injury, after long confinement in splints and other contrivances for preventing movement, failed to improve. Perhaps after months of patient perseverance under surgeons, such cases went to Mr. Hutton, driving to his door, and when, as often happened,

the knee was the affected joint, hobbling down his passage by the aid of crutches. In a quarter of an hour they came out briskly, deposited the crutches in the carriage which had brought them, and, by Mr. Hutton's order, walked home. They were assisted in this course by two alterations of condition, each of which was important in its bearing upon the result. The first was physical, depending upon removal of the traction previously exercised by an adhesion; the second was moral, depending upon the increased courage and power of effort given by the permission to use the limb, and by the assurance that no harm could arise from doing so. At the very time when Mr. Hutton was showing me his methods, almost this precise history had recently occurred in the cases of two gentlemen well known in society, who not unnaturally extolled the bone-setter wherever they went, and who spoke in terms of corresponding depreciation of the distinguished hospital surgeons by whom they had originally been treated. There was, of course, another side to the picture;

and a man unacquainted with surgery might easily make mistakes in his diagnosis, and might do mischief by his manipulation when rest was really indicated. When this was urged in opposition to bone-setters, the answer of the public was that doctors also made mistakes, but that they very seldom effected such rapid and remarkable cures. On the whole, the profession of surgery distinctly suffered in repute by the successes of Mr. Hutton, and gained very little by his failures.

It is only just to Mr. Hutton's memory to place on record to how great an extent he differed from the ordinary type of unqualified person, who lays himself out to practise some department of the healing art for the sake of gain. It is well known that in certain parts of the North of England a sort of village communism was continued into at least the early part of the nineteenth century, a system under which many occupations of general utility became hereditary in families, the members of which, it may safely be presumed, were likely also to inherit some special aptitudes for engaging

in them. Among these occupations, and at a time when many extensive districts contained no qualified surgeon, that of ministering to the necessities of people who had sustained bodily injury, and of treating real or supposed fractures and dislocations, held a somewhat prominent place; and, inasmuch as the revenue arising from it would seldom be sufficient to afford a maintenance, was usually combined with some form of industry more constantly in request. Mr. Hutton came of a family by which this rude surgery of the dalesmen had been practised for many generations, so that he had early been instructed in the traditional arts, and, as he considered them, in the "secrets" of the craft. He left his native place, established himself in business as an upholsterer, and carried on that business for many years, ultimately retiring from it with a competency; and it was not until he had done this that he was induced, primarily I believe in order to afford relief to a poor man in his neighbourhood, to try his hand at the work of restoring a crippled joint to

usefulness. One case led to another, and his successes among the poor, to whom his services were always freely given, led to their being frequently sought and remunerated by the rich. He was, I believe, a perfectly upright and honest man, thoroughly convinced not only of the propriety and efficacy of the treatment which he pursued, but also of the correctness of his ordinary diagnosis of "a displaced bone," however impossible it might be for any bone to be displaced in the joint concerned; but he was, in the estimation of the medical profession, "a quack," and the circumstance that he had neither qualification nor hospital appointment seems effectually to have quenched what might otherwise have been a natural and even laudable curiosity with regard to the causes of his success. In my own case, this curiosity was very strong; but, before endeavouring to satisfy it, I determined to protect myself against possible censure from my professional brethren by asking the advice of my old teacher and friend, the late Sir William Fergusson. He

replied to me with characteristic downrightness: "If you think you can learn anything from the man, go and learn it"; and I at once acted upon his counsel.

I watched Mr. Hutton's proceedings for about two years; and frequently acted as his substitute in his large gratuitous practice among the poor, although I declined to do so in the case of paying patients. Having fully satisfied myself with regard to the nature of his treatment, with regard to the class of cases in which it was calculated to be beneficial, and with regard to my own power of carrying out the manipulations in which he excelled, I discontinued visiting him, and followed my ordinary occupation as a general practitioner. What I had seen had been communicated to me in a confidence which I had no inclination to violate; and my newly acquired knowledge had little or no applicability to the forms of illness with which I was every day concerned. I did not see Mr. Hutton for perhaps two years before his death in 1871, but after that event it seemed to me that

my original obligation to keep silence with regard to his methods was no longer binding; and I felt that an account of his experience ought to be of great value to surgeons. I therefore prepared, and published in the leading medical journal, the *Lancet*, a series of articles explaining Mr. Hutton's methods in full detail, showing the arts of manipulation by which it was possible to break down adhesions with a minimum of resistance, and setting forth what appeared to me to be the pathology of the cases in which I had seen him achieve such remarkable success. In these papers I threw open to the members of my own profession everything which Mr. Hutton had shown to me; and enabled any practitioner of ordinary skill and intelligence to deal with stiffened and painful joints as effectively as Mr. Hutton himself. The whole mystery of "bone-setting," precisely what it could do and where it was useless or injurious, was laid open to the medical profession in the plainest language which I could command; and the papers were republished, in book form, as *A Treatise on*

Bone-setting, in the summer of the year 1871. I cannot refrain from adding that the late Sir James Paget, when republishing in 1875 a Lecture on *The Cases that Bone-Setters Cure*, which had originally appeared in print in 1867, referred to my work in the following terms: "Since the publication of this lecture, a valuable essay on bone-setting has been published by Dr. Wharton Hood, who has thoroughly learned the art, and practises it skilfully. He fully describes the several methods of manipulation, and no one can doubt their value when used prudently. . . . Dr. Hood's essay should be read on all these cases, not only for the manual treatment which he teaches, but for the signs which he indicates as decisive in the choice of cases. . . . On these, and, indeed, on all the cases of which I have been speaking, I recommend the study of Dr. Hood's essay. It may enable any surgeon to do what I advised; 'to imitate what is good and avoid what is bad in the practice of bone-setters.'" A not unnatural consequence of the publication was that a considerable number of the

cases of old injury, which, if Mr. Hutton had been alive, would probably have gone to him, were induced to come to me; so that, for the next few years, I had abundant opportunities of practising the methods of manipulation which I had learnt, and which, in my turn, I had endeavoured to render generally available to all surgeons. These opportunities became, indeed, so abundant, that it was soon necessary for me to devote the whole of my time to their demands; and hence, after the death of my father, I so far gave up general practice as to decline attending new cases except as a specialist in the treatment of injuries, and otherwise confined myself to a few old patients to whom I was bound by ties of long and intimate association.

Before very long, moreover, a totally new field of experience began to offer itself to my observation. Mr. Hutton was seldom consulted about cases of recent injury; and, when he was, his management of them differed in no important respect from that which was common among the surgeons

who were his contemporaries. He ordered "rest," used ice, and applied evaporating lotions, with the not uncommon result that, in the end, adhesions were formed, and that he had to break these by "bone-setting" in his accustomed manner. As soon as cases of recent injury were brought to me in sufficient numbers to afford a satisfactory basis of observation, they gave me opportunities of carrying into practice that of which I had already, in the book on *Bone-setting*, pointed out the necessity; that is to say, "of reconsidering some of those traditions about rest and counter-irritation which had been handed down through successive generations of surgeons." For the purposes of such reconsideration, what had been done by Mr. Hutton offered no data, and it was necessary for me to begin from the beginning for myself; so that I am entitled to claim that, wherever I have departed from routine surgery in the treatment of recent injuries, the departure has been entirely the result of original observation and of personal experience. I may add that

such departures have been so successful in my hands as to render either spurious anchylosis or any other form of prolonged incapacity an event of very rare occurrence, and to push the so-called "bone-setting," the dealing with articulations left in a chronic state of helplessness, entirely into the background of my practice. I speedily arrived at the conclusion that too much rest was constantly given to cases of injury, chiefly from a groundless fear that the ordinary swelling of the affected part, and the incidental pain, were indications of "inflammation" which was likely to be increased by movement, and in that case to be productive of permanent mischief. I found this view, and everything based upon it, to be altogether erroneous, and certain, if persisted in and acted upon, to land a large proportion of cases in the hands of real "bone-setters" and of other unqualified and incompetent persons. The truth is, that all injuries, which are not attended by any external wound communicating with them, may be safely treated by rubbing, strapping,

and immediate and persistent use of the part, to be followed by exercises of a definite character if, during any unduly prolonged period of rest following the injury, any muscle has become partially disabled, and indicates its weak condition by pain at the affected spot.

It has long been my intention to lay before the medical profession an account of the methods which I have pursued in the treatment of recent injuries, of the principles on which these methods are based, and of the improvements in detail which from time to time have been introduced under the guidance of experience; and I felt that an ample justification of this course was afforded by the fact that my note-books now contain records of the cases of over 23,500 separate persons whose injuries have passed through my hands. Some five years ago, I found it expedient to diminish my labours, and determined to do this by association with a partner. Mr. Frank Romer, who joined me in that capacity, had been occupied for some years in general medical and surgical practice in the

country; and had conducted it, so far as the treatment of injuries was concerned, on the lines which had been laid down by his surgical teachers ten years ago, as by mine twenty-five years earlier. For the last five years he has seen with me cases to the number of about twelve hundred annually; so that he has had ample opportunities of forming an independent opinion with regard to the merits of the system which I have pursued; with the result that he is prepared to endorse everything bearing upon treatment which the reader will find in the sequel of this book. I may add that I am much indebted to him for the assistance which he has rendered in its preparation.

CHAPTER II.

THE SO-CALLED "BONE-SETTING" OF THE EARLY SEVENTIES.

THIRTY years have now gone by since the publication of the volume on *Bone-setting* referred to in the preceding chapter; and, as that volume may be taken to represent the starting point of my subsequent experience in dealing with recent injuries, it seems desirable to set forth a brief summary of its contents by way of introduction to the record of that experience itself.

"Bone-setting," then, as I witnessed it in the hands of the elder Mr. Hutton, and as I assisted him in practising it among his unremunerative patients, meant neither more nor less than the cure, by suitable manipulations and subsequent exercise, of conditions

of lameness, weakness, pain, or disability of some kind, usually consequent upon prolonged disease or old injury affecting joints, or structures entering into their formation. The conditions in question, or the great majority of them, were arranged under the following categories :

(1) Stiffness and pain of joints following fracture of one of the bones forming them. These cases were said to be of two classes : (*a*) simply stiff joints, rendered so by want of movement, and by having been included in the splints applied to the fracture ; and (*b*) stiff and swollen joints, which had been more or less implicated in the original injury.

(2) Sprains, whether of recent date or of old standing, which had been treated by rigidly enforced rest.

(3) Joints that had been kept at rest voluntarily for the avoidance of pain, either after some injury to themselves, or to the soft parts around them, or after some painful disease affecting either—*e.g.* a stiff shoulder joint following inflammation and suppuration of the bursa beneath the deltoid

muscle, or a stiff hip-joint after inflammation of the bursa over the great trochanter.

(4) Rheumatic and gouty joints.

(5) Displaced cartilages.

(6) Ganglionic swellings about the carpus.

(7) Subluxation of bones of the carpus and tarsus.

(8) Displaced tendons.

(9) Hysterical joints.

In the great majority of these cases, of whatever nature, there would be a history of prolonged, often of greatly prolonged, medical and surgical treatment; not seldom extending over months, and in some instance even over years, during which the patient had been debarred from following either the occupations or the amusements of his former life. The Hon. Spencer Ponsonby Fane, for example, whose case was described at length in the treatise, was thus disabled for two years, and even this period of time was frequently exceeded. The condition in which the patient most frequently presented himself was that the affected joint was slightly swollen or tumid, the integument glossy, or

exhibiting stains or scars from blisters, liniments, iodine, or similar applications, that all attempts to move the joint were painful, that movements in some particular direction were especially so, and that, if the leg were affected, it was unable to support the weight of the body. Pain was seldom felt during perfect quiescence, but there would usually be a tender spot, easily discoverable by feeling for it, which would be acutely sensitive to pressure. In the presence of a condition of this kind, Mr. Hutton was accustomed to declare that "a bone was out," and to proceed to rectify the mischief by manipulation. Adopting various devices of grasping and of position, by which the muscles were hindered from assuming an attitude of resistance, he suddenly bent, extended, or rotated the limb, keeping at the same time firm thumb pressure upon the tender spot; usually with the result that something would be heard to snap or crack, and that freedom of movement and freedom from acute pain would be at once restored. He would then assert that the displaced

"bone" had been restored to its proper position; but what had really been done was to break through some adventitious adhesions, perhaps sometimes within the joint and sometimes external to it, by which movement had been hindered, and which dragged painfully upon neighbouring tissues as long as the movement was insufficient to restore the natural freedom. We saw many patients in whom attempts at what were called "passive movements" had been made by surgeons; but these passive movements, as a rule, had been insufficient to overcome the opposition, and were frequently followed by evidences of resentment on the part of the tissues, normal or adventitious, which were subjected to them. In other words, pain and tenderness were increased, and freedom of voluntary movement was not obtained. Alarmed lest the attempted movement should be followed by "inflammation," the surgeon usually sent the patient to bed, placed the affected limb in a splint, and applied ice to the neighbourhood of the joint. In other words, he afforded any stretched or partially

ruptured adhesions time and opportunity to reunite and consolidate; and the patient, when comparative liberty was again restored to him, found himself no better for what he had undergone.

Three years prior to the appearance of my book, the late Sir James Paget had published the Lecture already referred to, *On Cases that Bone-setters Cure*, and in this he said that "bone-setters violently move the joints against the muscular resistance until the muscles are wearied and beaten." I do not know to what extent this may have been a correct account of the proceedings of some of the persons to whom the description "bone-setter" was commonly applied; but it was not applicable to the case of Mr. Hutton, who knew from tradition in what positions of the several limbs the muscles actuating them would be cheated out of their power of resistance, and who used these positions with great effect. He had really no other resistance to overcome than that of the adventitious structure, wherever or whatever it may be, by which free movement

was impeded. But the great difference between his "passive movements" and those commonly practised by surgeons was not only that the former were usually more complete, and carried to the point of overcoming the obstruction, instead of being interrupted when it was only irritated; but that they were never followed by absolute rest, and therefore never afforded the adhesions an opportunity of reunion. His injunction always was, "Use your limb," use it to some extent even to-day, and more and more every day hereafter. Of course, the muscles were often weak from prolonged inaction, and soon became fatigued, but all acute pain was invariably removed by rupture of the adhesions, and the muscles, enabled to resume their functions, usually rapidly recovered.

The precise pathology of cases of the class referred to must always, in the absence of opportunities for dissecting the affected parts, remain a little uncertain. I have, however, seen no reason to depart from the general views on this subject which I enunciated

thirty years ago, to the effect that the manipulation of many cases falling under the various categories already mentioned had convinced me that a joint kept at rest, from whatever cause, is almost certain to undergo changes in restraint of movement affecting either its own structures or those immediately surrounding it. It is probable that some constitutional states involve a special proclivity to such changes, and that they occur earlier in some persons than in others. Whatever their precise nature, they resist passive motion with a sort of elastic resistance, as if the joints were restrained by ligamentous or strong fibrous tissue. Possibly, in some cases, the proper ligaments may become contracted or rigid, or adherent to neighbouring parts; in others, external or internal adventitious fibrous bands may be formed; in others, muscles may have undergone shortening; a result which is constantly produced when they are kept contracted for long periods, on guard, as it were, against movements or positions which would be productive of pain. Again, effusion may have become solidified

or semi-organised, and thus movement be impaired, as if by a state of things analogous to a rusty hinge. It is even probable that one effect of rest may be to diminish secretion (the natural stimulus afforded by movement being withdrawn) both in the articulations themselves and in the sheaths of the tendons; and so to produce a kind of unnatural dryness, analogous to that which we may suppose to exist in the case of a horse that is "stiff at starting." In all, however, the impediment to motion becomes a source of pain when motion is attempted; and this pain is often erroneously looked upon as an indication for continued rest. A patient will unintentionally deceive his surgeon by saying that the affected joint "feels weak," thus using what is well-nigh the most indefinite phrase in the language, but one which seems naturally to suggest the use of some kind of mechanical support. While this is worn, it gives a slight increase of power, but its removal leaves the former condition essentially unchanged. The meaning of "weakness" in such cases is usually that the joint cannot

be moved without pain, and people only use the word for want of knowing how to describe accurately the existing condition. Any one who has ever had an attack of lumbago will understand this. A person so suffering feels "weakness," in the sense that his power to rise from the recumbent posture is apparently gone. It is not really gone, but there is an instinctive dread of calling the affected muscles into action; and this dread conveys to the mind an impression of inability to move, which can only be overcome by a determined effort of the will. The cases in which "bone-setters" attain their successes are those in which some restraint of movement, due either to an injury, or to the rest and treatment consequent upon it, or to both together, and which painfully checks the motions of the joint, admits of being at once overcome by manipulation.

The conditions thus described, which were at one time both common and frequently productive of the consequences natural to them, ought not, under the better knowledge of the present day, to be suffered to occur in

the hands of medical practitioners; and the chief object of these pages is to describe the methods and principles by which they may be prevented, and by which the art of the "bone-setter," either within or beyond the profession, may be rendered superfluous. In my original volume I entered into full details with regard to the manner of breaking down adhesions, and gave figures, drawn from life, of the positions, both of operator and of patient, which enable the former to evade the action of muscles by which his proceedings would be opposed. I shall now regard all this very much as ancient history, and shall not think it necessary to reproduce the figures in question, or to enter into minute detail with regard to the performance of manipulations which, save in exceptional cases, ought no longer to be required. These exceptional cases will, however, occur from time to time, and the methods by which they should be treated are of sufficient importance to justify some general observations on the subject.

In Mr. Hutton's time, the use of anæs-

thetics was far less general than it has since become; and, while it would have been out of the question for him to administer them himself, it would have been difficult or impossible for him to obtain the assistance of a qualified practitioner for the purpose. His patients were therefore called upon to endure the pain, much or little, of his manipulations; and it is probable that this circumstance served to place a useful check upon the extent to which they were carried at any one sitting, as well as upon the actual degree of force employed in conducting them. As I have already stated, Sir James Paget did not accurately represent Mr. Hutton's practice by saying that muscular resistance was "overcome"; the fact being that it was to a great extent evaded. Flexor and extensor muscles may, as a rule, be thrown almost completely off their guard by an endeavour to rotate the limb on the distal side of the joint upon which they act. Whatever power of resistance there may be will marshal itself, so to speak, against the

rotation, and a sudden flexion or extension will then take the opposing muscles by surprise, and will to a great extent find them unprepared. Methods of this kind had been handed down through many generations of bone-setters by tradition; and another security against the employment of undue force was afforded by the practice of resting one of the thumbs of the operator upon the "tender point" already mentioned, which probably corresponded with the attachment of whatever adhesion might first come into play in arrest of motion, and which would therefore be too close to the implicated joint to allow the hands to be sufficiently distant from it to bring the leverage of the long bones into active operation. Almost the only exception to this rule would be furnished by the method of flexing the thigh at the hip joint, for which purpose the leverage afforded by the length of the femur was commonly employed.

In the present day, however, and in the hands of persons competent for the purpose, chloroform, or still better, the mixture

known as A.C.E., should almost invariably be administered for the treatment of adhesions. The pain is worth consideration; but the chief object of the anæsthetic is to produce complete muscular relaxation. On this account, the administration of nitrous oxide gas is not to be recommended, because, under its influence, as shown by the daily experience of dentists, who find it necessary to place a plug between the molar teeth prior to the inhalation, in order to prevent the jaws from being tightly clenched during the period of unconsciousness, the muscles are left contractile, or are even thrown into a state of spastic rigidity.

I find, as a rule, that no very large quantity of the A.C.E. mixture is required, and that five minutes is the average time consumed in its administration. The patient being so far under its influence that the muscles are sufficiently relaxed, the operator is called upon to remember the condition of things with which he may have to deal, and to govern his proceedings accordingly.

If the limb has been long at rest, the bones will have shared in the general lowering of nutrition, and will be unduly brittle; while, in young subjects, the union between the shaft and the epiphyses may be weakened. It is therefore necessary, or at least prudent, to limit the effects of the first operation to such careful and gentle loosening of the joint as may render the operator conscious of having moved the articular surfaces upon one another. The next step should be gently to stretch the surrounding muscles, not carrying the movements beyond the limits of semi-flexion, extension, or abduction. These muscles have been so long on guard, as it were, in order to prevent painful movements of the joint, that they will usually have passed into a state of permanent contraction; and, if they are forcibly stretched, their fibres become strained, or even ruptured, and the operation may be followed by pain and swelling, requiring rest and the application of ice, and involving serious and unnecessary waste of time.

If A.C.E. or chloroform has been administered, and the manipulations of the surgeon discreetly conducted, the subsequent pain is inconsiderable, and seldom lasts more than half-an-hour; while, if nitrous oxide has been the anæsthetic, the pain is apt to be long continued and severe. The difference is unquestionably due to the difference in the condition of the muscles, which are relaxed under the former agent and remain contracted under the latter. The affected joint should be rubbed and gently moved on the night of the operation, and for two or three days thereafter, and then a series of exercises, intended to restore strength and flexibility to the disused muscles, should be commenced. These exercises should be conducted by the aid of ropes running over pulleys, and carrying light weights, in the manner to be more fully described hereafter. "Passive movements" are useless, because the attention of the patient is always directed to the process, and, however good may be his intentions, he is always automatically on guard against

the surrender of a weak or painful muscle to the very action which is most required for its restoration, and will not allow it to be so stretched as to produce pain. Any contrivance depending upon the elasticity of india-rubber is also useless, acting, as it must do, by jerks, especially in its return to its normal length after being stretched. The apparatus which I have found most useful, and best calculated to carry into practice the principles by which all exercises for this purpose should be governed, are the "Dowd Machine" and "Foot's Apparatus." All necessary exercises can be performed by the assistance of the latter, when the surgeon has decided what weights may be employed, and in what directions the principal movements should be made; and instructions on these points are satisfactorily carried out at the gymnasium to which I am accustomed to send my patients. In this mention of apparatus, I wish it to be understood that I am speaking with reference only to the particular class of cases under consideration; and that, for

sound limbs and healthy subjects, almost any of the contrivances in common use may be employed with advantage as aids to muscular development.

Even with light weights and cautious procedure, the patient will for some time be likely to complain of more or less pain in connection with the prescribed movements; and there is then some danger that the medical attendant may attach to these complaints more importance than they deserve, may fear that the pain will lead to "inflammation," and may agree with the sufferer that he should do less work, or even discontinue it altogether for a time. I regard all such fears as entirely visionary, and the customary pain as nothing more than a natural consequence of compelling a weakened part to resume its natural functions. I have never met with a single instance in which any evil consequence has followed perseverance in the exercises, whatever amount of pain may have been complained of in connection with them. It would be as reasonable to expect "inflammation" to follow a deter-

mination to walk in spite of the pain and stiffness left behind by the first day's hunting of the season, or by the first day's football, as to expect it as a consequence of properly graduated exercises of the muscles of a previously disused limb.

It was the custom of Mr. Hutton, before commencing his manipulations, to subject the patient to a certain period, a week or more, of some kind of preliminary treatment by fomentations, liniments, or what not; and in this respect his example has been followed by some modern surgeons who have given attention to the subject. One author on the subject, for example, states that "for a week beforehand (*i.e.* before an operation for breaking down adhesions) the part must be douched with hot and cold water, kneaded, and rubbed with stimulating liniment." It would be interesting to know what effect this course of treatment is supposed to be likely to produce, in what way or to what extent it would modify the pre-existing conditions, or in what respect the patient would be prejudiced by its being omitted. I have long

looked upon it merely as a survival of the apparatus of the unqualified practitioner, and have wholly discarded it without the production of any appreciable difference in my results. The same author tells us that "after forcible manipulation joints require the same kind of treatment as after a recent sprain. The limb must be bandaged at once, before there is time for swelling to set in, and kept absolutely at rest for 24 hours." From this teaching, also, I wholly dissent; and in many hundreds of such cases I have never met with one in which the suggested rest and bandaging was required, or in which it would have been advantageous. On the contrary, I am certain that to follow such a recommendation would have no other effect, in a large number of instances, than unduly to prolong the time which would elapse before recovery was complete. I have equally to express my dissent from a recommendation by the late Mr. Brodhurst, to the effect that division of tendons should be practised in some cases of the class now under consideration. My experience convinces me that, however much

the tendons may be contracted from mere disuse, they will always yield to gentle stretching and to subsequent perseverance in appropriate exercises.

Another writer whose opinions may be thought to call for notice in this connection, after speaking of the liberation of stiffened joints by forcible movement, expresses approval of an after treatment by fixing the limb in some splint or apparatus, and tells us that the joint should be kept at rest until all tenderness has ceased. He furnishes the best possible commentary on his own advice, by going on to say that "the great difficulty consists in getting a moveable, firm, and useful articulation, *as there is always a great tendency to refixation.*" The tendency in question is the not unnatural, or indeed the almost inevitable, result of the treatment which he has recommended. When direct physical impediments to movement, such as bands of organised lymph, have been broken through, they will reunite if the opportunity be afforded them; and this is most effectively done by rest. If the opportunity be not

afforded them, the affected joint will nevertheless be left weak, tender, restricted in its movements, and surrounded by muscles more or less crippled and contracted. These secondary consequences will yield to carefully conducted exercises, and they cannot reasonably be expected to yield to anything else. They can have no tendency to spontaneous cure, but they will certainly be overcome whenever a gradual return to the exercise of normal function is steadily demanded from the parts concerned.

CHAPTER III.

INJURIES IN GENERAL.

The injuries uncomplicated by division of the skin, which are incidental to the occupations and amusements of civilised life, and which most frequently call for some form of surgical interference, may be divided with approximate correctness into the two classes of those which are caused by external contacts, such as falls or blows, and those which are caused by some perverted action of the muscular system itself. The former class will include a few sprains; the whole category of fractures, with the exception of fractures of the patella and sometimes of the olecranon; dislocations, in which the effects of contact with the ground or other resisting substance are modified by the leverage arising

from some particular position of an extremity; and bruises or subcutaneous lacerations of deep tissues. The second class will include the excepted fractures of the patella and the olecranon; the great majority of sprains; and the whole of the numerous cases in which some sudden or unexpected demand upon a muscle—usually, therefore, a demand which it was not in a state of perfect readiness to meet—has been followed by a rupture of more or fewer of its fibres, by a detachment of some of these fibres from their tendon, or by partial or even complete laceration of the tendon itself, either at its bony attachment or in its course.

The symptoms of simple fracture have been minutely studied by many generations of surgeons; and it is probably not possible to say anything with regard to them which would be at once new and accurate. Crepitus, together with some shortening or distortion of the limb, must always be the prominent indication in any but exceptional circumstances; and it must frequently happen that adjacent soft parts are lacerated, either by

the fragments or by the force producing the fracture, and that more or less blood is effused into the surrounding tissues. When a fracture is in the neighbourhood of a joint, a question may often arise with regard to its precise relations thereto; and the difficulty of determining the point may speedily be increased by the occurrence or the increase of swelling. It is hardly necessary to point out that no pains should be spared in order to arrive at an accurate knowledge of the facts, and that valuable assistance in the inquiry may often be obtained by the administration of chloroform or of "A.C.E." in such a manner as to produce complete muscular relaxation, or by the employment of the Röntgen rays. Skiagrams are, indeed, often deceptive; but they afford a considerable amount of protection against the belated criticism of persons who are wise after the event. The rays, as used with the screen, are often really serviceable in fractures of the bones of the forearm, or of the metacarpal or metatarsal bones; and enable the surgeon at once to see what has hap-

pened; and in this way the expenditure of time necessary for the production of a print may be avoided. The screen is difficult of application for fractures of the humerus, tibia, or femur, or when a joint is involved, as, for example, in T-shaped fractures of the humerus near the elbow.

While, therefore, except for the Röntgen rays, little or nothing has been accomplished in the direction of facilitating the diagnosis of simple fracture, I am disposed to attach considerable importance to modified views of its pathology; modified chiefly in the sense of a better discrimination of the relative importance of changes which have never entirely escaped observation, but which have been looked upon, I think quite erroneously, as being of secondary importance. It has been the custom of surgeons to regard the perfect apposition of fragments as the matter entitled to the first claim on their consideration; and this view has served, I am abundantly convinced, to divert attention from principles of treatment which are much more worthy of being remembered.

I have already said that during the first four or five years subsequent to the publication of my book on *Bone-setting*, I was naturally called upon to see old injuries in larger proportion than recent ones; but that, before long, cases of the latter kind came before me with sufficient frequency to call for complete re-consideration of the methods commonly employed in dealing with them. For a time I followed the traditional practice of the school in which I had been trained; and, as long as I continued to do so, I had the mortification of finding that I brought about a number of imperfect recoveries, which had to be converted into cures by the methods which I had already described. My first steps in the direction of modified methods, although made very cautiously and tentatively, were in so marked a degree successful, as regarded alike the duration of treatment and its results, that I was speedily encouraged to carry them still further; and, for the last twenty years, I have never deviated from the principles and practice which I am about to describe. In that time

I have treated a very large number of recent fractures, occurring in almost every bone of the skeleton which admits of being broken.

If we set ourselves seriously to consider what is the exact state of a limb which has quite recently sustained a fracture of its bone or bones; say, for example, a fracture of the femur in the middle of the thigh, or a fracture of the tibia and fibula in the middle of the leg, we find, together with the fracture, two conditions which have been commonly regarded merely as complications or as necessary concomitants of it, but which are, in reality, and especially in relation to their consequences, of fully as much importance as, if not sometimes of more than, the fracture itself. These conditions are (1) swelling of the soft parts immediately around the seat of injury, spreading to a variable extent along the axis of the limb; and (2) more or less acute pain excited by any attempts at voluntary movement, or even occasioned by the automatic and almost spasmodic rigidity of neighbouring uninjured muscles. As a rule, there will be more or less injury to blood-

vessels traversing the bone, or so lying in its immediate vicinity as to have been implicated in the fracture, either by direct tearing or by laceration by fragments; and hence there will almost always be a certain amount of hæmorrhagic infiltration of the soft parts, to which serous effusion from their own tissues will speedily be added. These conditions constitute the beginning of the swelling; and, taken by themselves, would not necessarily be sufficient to render it very considerable in extent. They are soon reinforced, in all ordinary cases, by an almost complete stagnation of blood in the veins of the limb, and by a transudation through their coats of the fluid portions of the arrested current. The most elementary physiology teaches us that the ordinary flow through the veins is chiefly maintained by the pressure exercised by the alternate contraction and relaxation of the surrounding muscles, acting upon yielding channels supplied with an elaborate system of valves which guard against reflux; and, in the recent fracture, when the muscles of the limb are either disabled by

participation in the injury, or are thrown into steady and continuous contraction in order to obviate the pain produced by movement, this chief cause of the venous flow is thrown out of operation, and the effect ceases to follow. The veins become engorged; and, although they partially relieve themselves by transudation of serum into the soft parts, the arterial supply continues, and the engorgement and transudation continue and increase. This is the ordinary history of the swelling around a fracture; and it is a history fraught with consequences. The venous stasis implies a very serious interruption of all the ordinary nutritive changes in the affected limb, because it is, of course, thrown back upon the capillary circulation and upon the arterioles, and serves to detain in the former a quantity of blood which has been exhausted as a carrier either of oxygen or of nutritive material, and which is therefore unable to sustain normal reactions between itself and the tissues within which it is confined. The affected limb becomes generally lowered in vitality; and its power of initiating and

sustaining the changes necessary for repair is seriously diminished. While such a condition continues, little or nothing is gained by bringing the fractured surfaces into perfect apposition; for the simple reason that the injured parts will be unable to establish any fruitful reparative action.

A surgeon who is called to see a fracture at the place where the accident occurred, and who has to superintend the removal of the patient to his home or other abiding place, must, as a matter of course, apply some form of apparatus, either extemporised or designed, of such a character as to obviate any risk of further injury during transit; more especially the manifest risk of the conversion of a simple fracture into a compound one by the action of the sharp extremity of a fragment from within. The arrangements necessary for this purpose will, of course, vary with the seat of the fracture, the distance to be travelled, the method of conveyance, and the condition of the sufferer. In some cases, the manual support of an attendant may be sufficient; in others it may

be necessary to use splints or some substitutes for them, more or less firmly retained by handkerchiefs or bandages.

The patient having once arrived at a place of safety, the first principle, in the immediate treatment of fracture, is to secure merely such a degree of steadiness or comparative immobility of the affected limb as may allow pain to subside and swelling to be diminished, and may permit the uninjured muscles to relax the rigidity which had kept them on guard against any movement by which pain could be produced. For the fulfilment of this purpose, elaborate apparatus is, as a rule, not only superfluous but injurious; inasmuch as it must usually be retained in position by means which still further impede the already impeded circulation. In many cases, simple rest in bed will suffice; in others an arrangement of pillows or sand-bags; in others a light simple splint or splints secured by encircling strips of adhesive plaster. A single splint, when thus employed, should be made so much wider than the limb as to throw these strips off from its circumference, and

thus to obviate any general constriction at the points where they are placed. As a rule, splints should not be applied during the first two or three days, but the details of such procedures must differ greatly in different cases, and will depend partly upon the seat and nature of the injury, and partly, perhaps even chiefly, upon the personal character of the patient. Such information as can be given with regard to them will be found in the chapter in which special fractures are considered.

The next principle of treatment, and perhaps the most essential one, is to remove the local swelling, and the still more important blood-stasis underlying it, by the closest possible imitation of the physiological action by which normal circulation is maintained. That action, as we have seen, is intermittent muscular pressure; and the only effective substitute for it is manual pressure, so directed and applied as to produce a similar effect. The manipulation for this purpose must be a steady, uniform, gentle movement of stroking or squeezing,

directed from the distal towards the proximal portion of the limb, but always commencing on the proximal side of the injury, or at the proximal limit of the swelling. The object is to empty distended veins or water-logged connective tissue; and it is obvious, not only that both retarded blood and fluid effusion may most easily be made to pass on at the point where they border upon healthy structures, but also that the relief of the proximal portion of the swelling will at once open a door for the relief of the distal portion in a similar manner, and by a continuance of the same manipulation, commencing at a somewhat lower point. If the pressure were commenced on the distal side of the injury, all the fluids to be influenced would be pushed against the resistance of the accumulation nearer to the trunk; but, if the accumulation nearer to the trunk be first dealt with, that which is more remote may be made to follow in the same course with comparative ease. The procedure may be roughly likened to the removal of a cork

as the preliminary to emptying a bottle. In passing over the actual seat of injury, when that is reached, the pressure must, in the first instance, be exercised somewhat more lightly than over adjacent parts. There must be no friction, in the sense of rubbing to and fro, and none of the movements often included under the general term "massage"; but the operator must picture to his imagination a state of the limb resembling that of a full sponge, and must aim at emptying this sponge in a direction towards the trunk by a carefully graduated stroking or grasping and advancing pressure. The patient will often be a little alarmed at the prospect of being "rubbed," and it is therefore proper to begin in a tentative sort of way and with extreme gentleness, perhaps using only the palmar surfaces of the fingers; but even the very commencement of unloading the vessels of the limb will be productive of comfort, and a firmer application of the hand will soon be welcomed or appreciated. Such rubbing is best undertaken, of course, by a person who has had some experience

in similar manipulation, provided that he or she will do exactly what is directed, and will avoid everything beyond those limits; but, where a skilled operator cannot be obtained, the rubbing will often be perfectly accomplished, after a little instruction, by any intelligent member of the patient's family. The first rubbing should be done, as a rule, by the surgeon himself, as soon as the injured limb is safely at rest in bed; and should usually be continued for about half-an-hour. It should be repeated in about twenty-four hours, and, after the second occasion, whenever possible, twice a day. The position of the limb should in the meanwhile be rendered secure by the application, when necessary, of any form of light support which will admit of being so fixed as neither to impede the circulation nor to place any impediment in the way of action of the muscles.

In a very short time, however, in most injuries, the use of proper strapping will render it possible partly to abandon, or, at least, to supplement, the artificial stimulus

to circulation, and to the removal of effusions, which is afforded by rubbing, by the careful utilisation of the natural stimulus of movement. If the injured part is so supported by strips of plaster that the skin cannot expand before the increasing bulk of the muscles as they contract, this increasing bulk must compress the veins, and must squeeze forward any blood or other fluid which may be lying free in the interstices of the tissues. The strapping, thus applied, does not interfere with the systematic rubbing at stated periods, and it permits a steady continuance of a similar action during all the designed or undesigned movements of the patient. The plaster, for this purpose, must not be so applied as to be constrictive, or to compress the limb, but must be restrictive only, fitting closely to its actual somewhat increased circumference, and forbidding further increase of this circumference by muscular effort. In proportion as the patient perseveres in movements, and as the plaster fulfils its office, the swelling will be diminished, and the plaster will be

rendered loose. It must then be removed, and must be reapplied with only such a degree of tightness as may enable it to continue its original action. The details of its application, in different localities and in different injuries, will be most appropriately considered hereafter.

One of the serious consequences resulting from the state of immobility to which limbs the seat of fracture were formerly condemned was the muscular debility and wasting necessarily produced. When the time came at which union was supposed to be complete, and when the rigidly compressive splints and the tight bandages were removed, the limb was found shrunken, wasted, and incapable of exercising its natural powers; an incapacity only slowly recovered from even in favourable cases, and by which a certain degree of permanent weakness was commonly entailed, as well as a considerable amount of what may be called "fatigue-pain" under any conditions which required even moderate exertion. It follows from these circumstances that the prevention of muscular wasting by

timely movement may be described as the second indication to be fulfilled in treatment. The fear which, prior to experience, might be entertained that such movement would have any tendency to produce displacement of the fragments may be dismissed as wholly visionary; provided, of course, that the nature and direction of the movements permitted or enjoined be always governed by considerations based upon the position of the fracture, and upon the lines along which muscular force will be exerted.

In order to produce the desired effect, the muscular movements must be volitional, and not what are sometimes erroneously called "passive." There are no "passive" movements, except under an anæsthetic; and, if there were, they would not be conducive to the attainment of the end desired. A "passive" flexion of the knee-joint, for example, if it were really passive, would flex the knee-joint, and would alter the relative positions of the thigh and leg, but it would fail to call the flexor muscles into activity, and hence would fail to confer upon them

the advantages which would follow from their volitional contraction. Moreover, if flexion of the knee-joint were painful, by reason of any impediment to its performance existing either in the joint itself or in the muscles and ligaments acting upon it or entering into its formation, the first attempt on the part of the attendant to flex it passively would be met by the patient with active resistance on the part of his extensors, which would at once be thrown on guard, either volitionally or automatically, for the express purpose of preventing the painful flexure from being accomplished. The passivity of the process would disappear, and the activity would be exerted in a direction precisely opposite to that in which it was required.

Still assuming that flexion of the knee is the movement indicated, the way to produce it is for the attendant to say, during the rubbing process, "Try to bend your knee a little, if only an inch or so. You will find you can, if you try. Do not mind a little pain, which is inseparable from the first

action of a muscle that has been long at rest." Thus encouraged, the patient will try; and the essential difference between his trying and any effort to flex the knee made by the attendant will not only be that in the former the extensors will be completely relaxed, while in the latter they will be acting antagonistically, but also that in the former the flexors will be responding to their appropriate nervous stimulus, and will be attempting to discharge their natural functions in a manner certain to restore the power of discharging those functions completely.

In such matters it is the first step that costs. When the patient, in the case supposed, has learnt by experience that he can so far flex his knee as to draw his heel a little nearer to the ischium than it was before, he will at once realise that he has gained something. He should then be told to exert his newly-recovered power at intervals during the day; and at the next visit he will often be eager to show that the original range of movement has decidedly increased. When he reaches what he fancies

to be his limit, a judicious attendant will encourage him, and will say: "Just a little more; one more try; see whether you cannot bring up the heel to this point," at the same time placing his hand on some convenient mark as the goal of the renewed endeavour. In this way, another inch or two will be gained; and so continual progress will be made from day to day. Very often a weight attached to a cord running over a pulley will be found an useful adjuvant to voluntary effort; but the consideration of such details will be more appropriately undertaken in relation to the management of particular injuries.

In the initiation or continuance of voluntary movement, the great difficulty to be overcome, in a general way, arises from the production of pain; but pain only becomes a difficulty because it has been made a bugbear. Surgeons have persisted, in defiance of the plainest experience, in regarding it as a probable precursor of "inflammation"—almost equally a bugbear—and hence they have not only too often been checked in their pro-

ceedings whenever "pain" was complained of, and have thus developed an inordinate dread of it in the mind of the patient, but they have also regarded the occurrence of pain as an indication for another period of so-called "rest," by which, in many cases, the ground already gained has been lost, and the patient restored to his original incapacity, whatever that might be. All muscular effort that is excessive for the muscle performing it is attended and followed by perfectly harmless pain; and very slight or ordinary effort is excessive for a muscle that is flabby or wasted from disuse. The pains of parturition, the pains incidental to the first day's hunting of the season, or the first day's cricket, or the first day's football, are all examples in point; and they produce no evil consequences, nor even the dread of any. They possess the common character of ceasing when the muscles in which they occur are in repose; and they only arise when these muscles are exerted or handled. The liability to them disappears from voluntary muscles as these are strengthened by exercise; and they

differ absolutely, alike in character and in significance, from any form of pain that is continuous and independent of local activity. It was the non-recognition of this fact, the non-recognition of the fundamental differences between the causes and the significance of different kinds of pain, the conception of pain as, so to speak, a single entity, which vitiated much of the otherwise excellent work of the late Mr. Hilton, and led him and some of his followers into the paradox of supposing it possible to restore mobility as a function by the prolonged maintenance of conditions carefully planned for the purpose of rendering movement impossible. If their opinions on this subject had been well founded, it would almost have followed that the discipline of an Indian fakir would form a suitable preparation for the calling of an acrobat.

The period at which gentle movements should be commenced after a fracture will vary, of course, with the actual conditions of individual cases; but, in the great majority, will be somewhere between a week and a fortnight after the occurrence of the injury.

The directions to which these movements should in the first instance be confined will be most appropriately considered when the special questions arising in the cases of particular bones are being dealt with, and these must, of course, be looked for under their respective headings in a subsequent chapter. I may, however, point out here that the general principles underlying the methods which I advocate, and which I have practised without variation for more than twenty years, have of late been making some way in the profession at large, although by no means to the extent, or always even in the direction, that my own experience has shown to be most conducive to the attainment of perfectly satisfactory results. The first public announcement of them, as far as I am aware, was made by Dr. J. Lucas-Championnière, whose *Traitement des Fractures par le Massage et la Mobilisation* appeared in 1895; and who has been followed, more or less, by several English surgeons, among others by Sir William Bennett at St. George's Hospital. I have already said enough to show that I

regard the application of "massage," as opposed to simple friction in a direction towards the trunk, as a mistake, although I have no doubt that a fracture treated by massage would, on the whole, do better than one treated in the old-fashioned way, by permanent splints and complete immobility. Sir William Bennett, as I gather from the accounts of his treatment contained in his papers in the *Lancet* and the *Practitioner*, or in Mr. Pickering Pick's *Surgery*, is accustomed to put up—say, a broken leg—in the old-fashioned back and side splints, to remove the latter for a daily rubbing, and then to readjust them; and his experience seems to be in entire accord with my own as regards the comfort thus secured to the patient, and the increased rapidity and firmer character of the union. I feel confident that, as time goes on, he will realise the still greater benefit to be derived from that complete abandonment of side splints which will hereafter be advocated in fractures of the class in question. Sir William's present position appears to be very similar to that which I

myself occupied twenty years ago; and he will be likely gradually to feel his way, as I had to do myself, to a continually increasing reliance upon the reparative powers of the body, if the exercise of these powers be but promoted by physiological means, and to a continually increasing sense of the entire superfluousness, to say the least, of many of the appliances upon which the surgeons of an earlier period were accustomed to rely.

The foregoing observations are limited in their application, as has been said, to cases of simple fracture; and it will be obvious that even the principles underlying them have only a partial or restricted application to compound fractures, in which the primary necessity, even for the preservation of life, must usually be the establishment and maintenance of an aseptic condition of the wound, and in which the solution of skin continuity will often permit the draining away of much of the primary effusion of blood at the time of the injury. It is none the less true that, in compound fractures as in simple ones, much mischief

may be wrought, or, at the very best, much time may be lost, by the unnecessary prolongation of immobility; and hence, as soon as the above mentioned primary necessity has been provided for, and the patient is secure against the intrusion of septic organisms, in most cases the best recoveries, and in all cases the quickest, will be obtained by those surgeons who make the earliest use of carefully regulated and well directed movements, analogous, in the case of each bone, to those which will be described with reference to it in the sequel.

On the general subject of dislocations there is not a great deal to be said, except that the principle of preserving mobility of the joint by exercise, instead of endeavouring to restore mobility after it has been sacrificed by disuse, is fully as important in these cases as in those of fracture, and must be acted upon in an analogous manner. In the reduction of a dislocation, it is generally desirable to relax the muscles by an anæsthetic, and the sole force employed should be that of manipulation, guided

by anatomical knowledge, and assisted by the leverage afforded by the limb itself. The displaced head of the bone must, whenever possible, be so guided as to retrace on its return journey the path by which it went astray; and, as soon as it is in correct position, some check must be placed upon any movements by which renewed displacement might be effected, while all others are permitted or encouraged, and daily frictions are employed to disperse swelling, and to promote the absorption of any blood or other effusion which may have found its way either into the joint itself or among the fibres of the muscles surrounding it.

In the case of the injuries commonly described as "sprains," and which the experience of our ancestors taught them often to regard as more serious and more permanent in their effects than fractures, the nature and amount of the damage done may vary within rather wide limits. Sprains are of two classes, those in which a joint is carried beyond its normal range of movement by some external force by which the

natural inhibition is overcome, and those in which this inhibition is imperfect. A man falling with his ankle bent under him would furnish an example of the former, a man turning hastily on his foot when the leg muscles are unbraced will often furnish an example of the latter. In the former case almost anything may be done; and the symptoms often point to some tearing of ligament. There is usually acute and sickening pain, complete inability to rest upon the injured limb, and speedy and considerable swelling, precisely of the same character as that which follows fracture. In cases of the second class the force applied is less than in the former, the most common injury is the rupture of a few fibres of some muscle that has been taken unawares, and the symptoms, both immediate and remote, are less severe. In both, the indication to be fulfilled is to prevent the formation of any adhesions due to the organisation of effused lymph or blood, and to preserve the muscles from the wasting incidental to disuse. The first aim of treat-

ment should be to procure the disappearance of the swelling; the second to encourage the performance of the movements or other natural functions of the joint; and procedures directed towards both may be carried on simultaneously. Rubbing, mechanical support, and exercise, are the three great remedial measures, and they may all be applied from the beginning, except in very severe cases in which the swelling has attained considerable magnitude before the case is seen by the surgeon. In these circumstances, a day or two of rest in bed, devoted to diminution of the swelling by properly directed friction, may be a desirable prelude to support and movement; but it is essential that these latter should always go together, and that movement should be performed as soon as support can be applied.

In the very large class of cases which bear some analogy to sprains, but in which there has been some laceration of muscular fibre at a distance from a joint, the conditions met with are almost infinitely various. Such

accidents usually happen to a muscle the antagonists or neighbours of which are in a state of unpreparedness to assist or steady it, so that some stress falls upon it which it is not ready to meet. A sudden muscular effort in an unexpected direction, as in the case of the rider of a falling horse, may be taken as an example in point. The surgeon will find a certain amount of local pain or tenderness, increased by movement, and in some cases a sulcus in the continuity of the affected muscle will be discoverable, but this is seldom conspicuous, and shows no tendency to increase, because any portion of a muscle that is torn from its attachment soon loses its disposition to contract. If left to his own devices, the patient will perhaps remain in bed for a day or two, and will keep the affected limb as much at rest as possible, in order to avoid producing pain by movement. When he gets up, he will more or less continue the same practice. Movement in some particular direction, that is to say, the movement which it is the business of the injured

muscle to perform, hurts him, and as far as possible he avoids it. In order to do this, he has also to cease or to restrict the movements of the limb generally. In a little while, the muscles thus kept inactive begin to waste, and the circumference of the limb will soon undergo a notable diminution. The patient goes on, waiting for the expected time when the maintenance of rest will have restored the power of movement; but this time does not come, and he finds himself more helpless week after week. There is usually pain at night, chiefly seated near the point of attachment of the injured muscle, and this depends upon the fact that, during sleep, the other muscles relax the guard they have been accustomed to maintain against chance movements in some particular direction, and these movements sooner or later occur, and produce the pain on account of which they have been avoided. The histories of these cases are curiously monotonous; and the chief differences between them are in respect of their length. Until or unless

properly treated, the disability involved will extend over weeks, or months, or even years, according to the degree of patient endurance manifested by the sufferer.

It may usually be assumed, nay, it is usually manifest, in such a case, that the number of muscular fibres which are torn bears a very small proportion to those which remain intact, and the latter deserve the first consideration of the surgeon. Possibly some of them may be a little strained or stretched, and may be tender for a time in consequence. This tenderness may justify the indulgence of a day or two, but it does not justify rest of a duration calculated to lead to wasting. The absolutely torn fibres cannot be expected to reunite, because their contraction is at least sufficient to produce an absolute break of continuity in their course; and the whole object of treatment should be to keep the limb in activity until its functions are once more easily performed by the fibres which remain. At the time of the injury, the movements of the rest of the affected muscle should be gently restrained

by strips or bands of adhesive plaster, of width adapted to the size of the limb, and the method of applying them is of paramount importance. The object is not to exercise compression of the limb in its passive state, but simply to supplement the skin by a covering of precisely the same degree of tension as itself, but differing from it in being inelastic. Suppose, for example, that muscular fibres are ruptured in the middle of the thigh, and that a sulcus is discoverable at the seat of injury. A strip of plaster should be made completely to encircle the limb an inch or two below the sulcus, a second, partially overlapping the first, should cover the sulcus, and a third, overlapping the second, should extend to an inch or two above the sulcus. The strips should be merely *applied*, not drawn tight, but made to fit the surface of the skin when all the muscles are at rest. By the mere application, thus effected, no pressure upon deeper parts is exercised, and no arrest of or impediment to the natural circulation is produced; but, as soon as the muscles are

brought into action, the expansion of the skin which would otherwise occur is resisted by the plaster, and the muscular pressure is directed upon the veins, and promotes the forward movement of their contents, and an absorption of any fluid that may have escaped into the tissues by transudation through their walls. In other words, the commencement of muscular movement is speedily followed by the reduction of the certain amount of swelling which always follows such an injury as that under consideration; and hence, in a day or two, the plaster will cease to fit accurately. It will have become loose and must be re-applied in the same manner as at first. No similar effect can be produced by any form of bandage, because a bandage must in the first instance be applied tightly, or it would slip and altogether lose its effect; and, being tight, it would impede the circulation and do harm instead of good. Few people, moreover, are sufficiently skilful to apply a bandage in such a manner that its pressure shall be uniform fold after fold; and alter-

nations of tightness and slackness are even worse than either condition uniformly maintained. Another advantage of the plaster is that it places no difficulty in the way of the rubber, who may carry on his manipulations without reference to it, and treat it exactly as if it were itself the skin which it covers and supports. The plaster once applied, the patient should be instructed to lose no time in commencing the performance of voluntary movements in the very direction which the injury itself would at first sight appear to inhibit. Rubbing should be practised daily; and may often be performed by the patient himself if the seat of injury be sufficiently accessible. A continually increasing range of movement should be obtained by the sort of guidance already mentioned in speaking of fractures; and the patient must be taught to disregard any pain which the movements may produce, and to be assured that it will soon cease under the influence of perseverance. He may be told, as a rule, that the pain, although it may be disagreeable, and will hurt *him*, will not hurt

his limb. It is in the conduct of the movements required in such cases that the use of weights and pulleys is chiefly to be recommended. As soon as the weight has been raised by the movement as far as the patient can bring it, it tends to replace his limb in the original position, and its action is uniform and gentle throughout the whole of its range. In this respect it differs very advantageously from any contrivance made of india-rubber, which offers a constantly increasing resistance to movement, and which, when the movement ceases, tends to restore the original position with a jerk. The whole treatment, in short, should be based upon endeavours to prevent wasting of the uninjured portions of the muscle, or to restore function and nutrition in cases in which wasting has been suffered to occur.

CHAPTER IV.

INDIVIDUAL FRACTURES.

In approaching the consideration of the individual fractures, and the several modifications of treatment which they may require, it may be premised that certain bones may be left out of consideration. Fractures of the skull, of the scapula, and of the pelvis usually depend for their importance upon the extent to which the contents of the respective cavities may have participated in the injury; and the conditions thus arising are often of such a nature as to throw the mere breakage of bone into comparative insignificance. In describing the treatment of the common forms of fracture of the extremities, it seems convenient to take these in anatomical order from above downwards, commencing, of course, with the clavicle.

In *Fracture of the Clavicle* it was the accepted custom, when I commenced feeling my way towards modifications of treatment, to employ an apparatus of restraint which frequently inflicted the most acute suffering upon the patient. A large wedge-shaped pad, with its base upwards, was placed in the axilla, and the whole of the extremity, with the fore-arm at semi-flexion, was then tightly bandaged to the trunk. The pad arrested or impeded the circulation through the axillary vessels, and speedily became a source of pain and swelling; while the constrained posture and rigid confinement of the arm, and the swelling of the hand, which was usually suffered to remain outside the bandage, also became extremely irksome. Union was in most cases eventually obtained, but nearly always with marked distortion of the bone; and the restoration of usefulness to the limb was invariably a slow and painful process.

A patient with fractured clavicle, when placed in a position of comfort in bed or on a couch, and sufficiently supported, should be

gently rubbed for a time in a direction downwards, that is to say, from the lower part of the neck towards the shoulder, the weight of the arm being carefully supported while this is being done. The fragments should then be brought as nearly as possible into correct relative position, and three strips of firm adhesive plaster, each an inch and a half in width, should be applied, from a point immediately above the nipple to a point two inches below the angle of the scapula. The middle strip should cover the seat of fracture, and should be the first applied; the lateral ones, slightly overlapping it, should extend about an inch and a half on either side. Each strip should first be made to adhere strongly in front, and, while it is supported and fixed there by the fingers of one hand, should be carried over the shoulder by the other, with steady pressure, and made to adhere as it goes. These strips will afford firm support to the parts, and will check any tendency of the fragments to project forward, while projection backward will be restrained by the expansion of the chest in

inspiration. It is necessary, of course, that the plaster should be of a material which will adhere to the skin with sufficient firmness, and that it should be spread upon a suitable tissue; requirements which are well fulfilled by that which is known as "Mead's," and is sold upon metallic reels of various widths. At all ordinary temperatures this will be sufficiently adhesive without warming; but, if ever necessary, it may be warmed in the customary manner by placing the back of the tissue in contact with a vessel of warm water. The subsequent daily rubbing should be performed outside and through the plaster, which will not require to be disturbed until loosened by the subsidence of swelling, but which, in that event, should be taken off and renewed.

Except the plaster, no apparatus of restraint is either necessary or beneficial. In order to facilitate dressing and undressing, it is expedient to cut open the shirt down the front, so that it may be put on like a coat; and also to rip up the inner seam of the sleeve of both shirt and coat, and to attach

tapes by which they may be tied. The patient may get up daily, supporting the weight of the arm by a sling for the whole of the first day or two, and for a few days longer when out of doors. This, as a rule, is sufficient; but in exceptional cases the employment of the sling may be prolonged. It is sometimes useful out of doors as a danger signal, a sort of substitute for the red tape which has lately been so much affected as a sign of recent vaccination. Sometimes, too, the weight of the arm will drag painfully, especially when in bed and the muscles are relaxed in sleep, so that the patient may be awakened by a pain which he does not experience in the daytime. Apart from such conditions, the sling should be abandoned as soon as possible, and the arm should be left free to fall into its own position and to do its own work. From the first, moderate underhand movements are to be permitted and encouraged; but nothing heavy should be lifted, and the arm must not be raised, although there may be free play from the elbow downwards, and a somewhat more

limited backward and forward movement of the humerus from the shoulder joint. Special attention should be paid to the performance of the last mentioned movements in all eases in whieh the injury has been attended by any eontusion of the shoulder, and in whieh, therefore, there would be more than ordinary liability to stiffening within or around the joint. By the end of a week, quite free movement in all downward direetions may be allowed; but still no lifting, espeeially no lifting of a weight; and eare must be exereised in sueh a proceeding as putting on an overcoat. The patient will gain eonfidenee as he gains strength, and will before long beeome a eompetent judge of the efforts whieh he may safely endeavour to make. The plaster should be worn until perfeetly firm union has been obtained; and it will generally be found that the shape and relations of the bone have been well preserved. The time required will depend, of eourse, upon sueh eonditions as the age, health, and general reparative power of the subjeet; but, in the majority of eases, a

month will suffiee for restoration to the freedoms of health.

The best pattern of sling, for nearly every eondition in which sueh an applianee is required, is formed of two strips of eloth or webbing, about two inehes wide, and of length proportionate to the size of the wearer, united together about the junetion of their middle and upper thirds by a transverse band of the same width and material, long enough to reaeh nearly aeross the baek. Where the transverse band joins the longitudinal ones the latter should be eut or stitched in sueh a manner as to be set out a little both above and below the join, so that eaeh longitudinal band is an obtuse angle instead of a straight line. The lower end of eaeh longitudinal band should have a buekle of its own width, through whieh the upper end may be passed. The transverse band rests on the baek between the shoulders, and supports the weight of the suspended limb, and eaeh longitudinal band ean be tightened independently, aeeording to the position in whieh the hand and fore-arm are to be retained.

In *Fracture of the Humerus* the system of management will to some extent depend upon the position of the injury. A fracture in mid-arm will almost certainly require the support of four splints while the patient is being taken home; and, when he is safe in bed and his clothing removed, it will usually be necessary to apply a single splint along the inner side of the arm, and to secure it by one or two encircling strips of plaster, one of which should surround the seat of injury. The support afforded by this splint will permit rubbing to be performed in the ordinary way, through the plaster, which, on the principle already laid down, must encircle the arm without compressing it. After the rubbing, the inner splint and plaster must be left intact; and three more splints applied, so as to surround the limb on every side. These may be secured by tied tapes, or, still more conveniently, by strips of webbing furnished with buckles. The elbow should be semi-flexed; and the fore-arm supported by a sling, which should not extend to the elbow, in order that the weight of

the arm may assist in maintaining extension when the patient is in the upright position. The shirt and the sleeves should be cut in the manner advised for fractured clavicle; and the patient should be permitted to dress daily, and to remain in a chair or on a sofa, or to go out of doors as may be most agreeable to him. Voluntary movements of the fore-arm, hand, and fingers, as for such a purpose as cutting up food, should be practised from the first; and the patient should gently flex and extend the fore-arm two or three times a day, for the purpose of avoiding any stiffening of the elbow. After three or four days, the anterior and posterior sections of the deltoid may be called upon to perform movements at the time of the daily rubbing; and the patient will soon gain sufficient confidence to bring the central portion of the same muscle into play, and to attempt a slight raising of the arm from the side, while the chief weight is supported by the other hand under the fore-arm. This second hand should not itself lift the injured arm, but should only follow its voluntary

movement, and support it when it is lifted by its own muscles. An intelligent patient will speedily understand the principle of action, and his own sensations will be the best guide to the limitations of his endeavours.

In fracture of the humerus near either extremity, the necessary support will be best given by poro-plastic splints moulded to the arm in two parts, an inner and an outer, the latter of which may be removed for the daily rubbing, leaving the former to bear the weight of the arm during the process. Near the shoulder joint, the outer splint would take the form of a cap covering the deltoid region, while the inner one would go well into the axilla; and, near the elbow, both splints would bend round the joint in its semi-flexed position, as that which is most convenient and comfortable for repose. A fracture near the shoulder will, of course, greatly limit for a time the permissible range of movement of the shoulder joint itself, while the elbow, wrist, and fingers may from the first be exercised with considerable freedom; while in a fracture near the elbow

these conditions will be to some extent reversed. Whatever the position, the principle to be borne in mind remains the same; namely, that daily rubbing of the neighbourhood of the injured part is the great means by which its circulation will be maintained in a healthy condition, and its inherent powers of repair preserved; while movements of every muscle which can be called into play without absolute disturbance of the position of the fragments will afford the only possibility of preserving undiminished the natural freedom and strength of the limb. Where the line of fracture is such as to render movements more difficult than usual, the difficulty may often be overcome by careful manual support from the attendant while the early efforts are being made; and such support must in needful cases be unhesitatingly afforded. Anything is better than suffering the muscles of the limb to pass into a stiff and wasted condition, under the influence of a groundless fear that their action would be likely to disturb the apposition of the two portions of the bone.

In cases in which the olecranon is detached from the shaft of the ulna, a question will sometimes arise as to whether the two portions should be brought together by the insertion of wires, and the performance of such an operation has been advocated by many surgeons. In my opinion it is uncalled for and unadvisable. Excellent results may be obtained by slinging the arm and rubbing, with movements of the joint in the directions of flexion and extension. Firm fibrous union will occur between the separated parts, and a good and useful joint will be procured, even if the ultimate separation should be as much as an inch.

In fractures of the radius or ulna singly, an encircling strip of plaster will afford sufficient support; but, when both bones are broken, the ordinary splints may be applied and worn between the rubbings. The same applies to the form of fracture of the radius known as "Colles's," in which the weight of the hand tends to displace the lower fragment, and for which the best splint is "Carr's."

Fractures of the metacarpal bones are easily

detected by the use of the Röntgen rays. They should be treated by the application of a pad of wool or of inflated india-rubber, sufficiently large comfortably to fill the palm of the hand, and secured in that position by a few strips of plaster. The rubbing should be on the dorsum of the hand, through the plaster, and the fingers and thumb should be used freely from the first.

In *Fractures of the Ribs* it will sometimes happen, of course, that the point of a broken bone may enter the pleural cavity, or may even wound the lung, and the surgeon must be on his guard against symptoms hence arising. Putting these on one side, the only treatment required is the firm application of two or three strips of plaster, the central one covering the seat of injury. They should extend from the vertebral column to the middle line in front; and should be applied when the chest is as completely as possible emptied. For this purpose the patient should be directed to take a deep breath and then to expire strongly, the injured part being supported by the hands of the surgeon while

this is being done, and until it is accomplished in a satisfactory manner. After one or two attempts, complete expiration will be effected; and the first strip of plaster must be applied prior to the commencement of inspiration. Daily rubbing must be performed in the usual manner, the main action of the hand being from the back of the chest towards the front; and, in uncomplicated fracture, considerable freedom of action may at once be conceded.

Proceeding to fractures of the lower extremity, we come next to *Fracture of the Neck of the Femur*; an accident which has condemned hundreds of elderly people to a period of miserable confinement, from which they were only released by death. It was formerly common to see the patient confined to bed, restrained by sandbags or other contrivances, and forbidden to make any attempt at movement, a course under which the muscles of the thighs underwent speedy wasting, of sufficient completeness to render recovery, at the ordinary advanced period of life to which the accident is almost restricted, not so much unusual as impossible.

By acting upon the principles which have already been laid down, and by preserving the muscles from atrophy, it is usually possible to obtain the establishment of a good and useful false joint, such as will allow the patient to return to many of the occupations and amusements of life.

In order to obtain this result, it is necessary to leave the limb entirely unrestrained and unhampered. No splint or bandage of any kind should be applied, and the patient should be suffered to lie quietly in bed, in whatever position the greatest comfort is experienced. The use of any extension apparatus, as advised by some surgeons, is especially to be condemned, and always tends to increase shortening. Assuming it to be applied, as it is most frequently, by means of a weight attached to the foot, and running over a pulley, its only effect is to call the muscles into continuous contraction against the pull, so that not only is the lower portion of the bone drawn upwards, but, in many cases, a permanent and irremediable shortening of the limb is produced. All that need be done

for the muscles may be accomplished by voluntary movements and assiduous daily rubbings, which should extend from below the seat of fracture to the glutei and muscles of the back. At the age at which the accident usually happens, union of the fracture never occurs, and it is useless to endeavour to obtain it; so that the efforts of the surgeon should be solely directed to the preservation of the strength and usefulness of the muscles. The fracture is occasioned, as a rule, by some slight fall, and is seldom associated with any important disturbance of the soft parts, which therefore do not require any long period of repose, and which should, indeed, be compelled to resume activity almost from the first; so that, free movements of the limb being permitted or encouraged, the circulation is carried on as usual, and deposit is squeezed away from the tissues in the neighbourhood of the injury. The thigh being supported, efforts should be made slightly to extend the leg; and the patient should also be made to grasp a webbing band, securely fastened to the foot of the bed, and, by its assistance,

to lift the trunk as if towards a sitting posture. Within a week, the patient should be taken out of bed, and made to commence progression upon two crutches, one of which should after a few more days be laid aside. The weight of the limb should at first be supported by a sling from the neck; and with this and one crutch the patient must soon commence to bear upon the foot, first to feel the ground with it, and soon to rest upon it. The first efforts in this direction will usually require a good deal of encouragement and superintendence from the surgeon, the impediment to them being fear rather than inability; but under judicious management confidence will soon be gained, and gained in a sufficient degree to permit the substitution of a convenient walking stick for the crutch. Definite muscular exercises should be continued for a considerable time, and the general tone of the whole muscular system of the limb should be sustained, and, generally speaking, improved, by daily rubbings. I can best illustrate the excellence of the result that may be thus obtained by

relating the case of a lady whose sole complaint, after her recovery from fracture of the neck of the femur, was based upon the shortening of the limb. I explained to her, between jest and earnest, that for this there was only one remedy, namely, to sustain the same injury upon the other side; and, either by accident or design, she availed herself of this remedy within 18 months after our conversation. The recovery from the second fracture was as good as from the first; and she now walks about perfectly well, and suffers no inconvenience. Many people fail to appreciate the fact that the maintenance of the erect posture, or the maintenance of position generally, is not due to any rigidity of the skeleton, but entirely to the steady tonicity of the muscles which, like opposing guy-ropes, sustain the central shaft. This is well illustrated by the training necessary for acrobats, who learn, for example, to descend upon the perineum by allowing complete abduction of the lower extremities, or to bend the whole body backwards until the vertex touches the ground. Neither the

skeleton nor the ligaments by which the bones are connected place the smallest difficulty in the way of either movement; the sole inhibitory structures being, for the former, the abdominal muscles, and, for the latter, the adductors of the lower extremities, and the whole training being directed to teaching these to yield in a greater degree than they are disposed to do at first. Just in the same way, the stability of an elderly person is very little affected by a false joint in the neck of the femur; but is very greatly affected, or even altogether destroyed, by weakness of the muscles whose function it is to preserve the relative positions of the pelvis and of the lower extremities.

For fractures of other parts of the femur the same principles must be borne in mind. A double inclined plane is the best temporary apparatus for fractures in the upper third of the shaft or for fractures immediately above the condyles; but Liston's long splint is to be preferred for those in or only just below the middle third of the bone. The seat of injury should be supported by strips

of plaster, and slight flexion of the knee, with some assistanee, should be eommenced about the fifth or sixth day, and daily but carefully increased in range. As confidenee is gained, forward movements—that is to say, endeavours to lift the limb as a whole—should be eommeneed, the hand of the attendant at first supporting it, but not taking any part in the actual lifting. Something like six weeks must usually be allowed to elapse before erutehes are permitted; and from this time rapid progress may be expeeted. If the surgeon takes proper eare of the museles, the injury to the bone may almost be left to take care of itself. It need hardly be said that, in every injury whieh requires the foot to be kept in a position in whieh it would be exposed to the weight of the bedclothes, this weight should be supported in some other manner, either by a eradle (designed or extemporised) or by stitehing to the bedclothes one end of a pieee of tape, whieh is then either carried over a pulley or tied to the framework of the bedstead.

In fractures of the patella, the chief efforts of surgeons have been directed to obtaining the closest possible approximation of the fragments; and lameness or incapacity associated with their permanent separation has constantly been attributed to this condition, instead of to its actual cause—impairment of muscular strength and efficiency by prolonged confinement and inactivity. I once saw a patient who mentioned, in the course of talk, that he had sustained a fracture of the patella; and I asked him as to the completeness of his recovery. He replied that he could ride forty miles a day or walk twenty, and that no one ever discovered that he had been injured. I asked to look at so good a result, and found the upper half of his patella separated from the lower by about one-third of the length of the femur. The only treatment required for such an injury is to send the patient to bed for a day or two, with the usual daily rubbing of the seat of the injury. About the fourth day a strip of Mead's plaster, three inches wide, should be so applied as to encircle the thigh in the

lower third, and to steady and control the movements of the extensors, the lower margin of the strip not deseending low enough to interfere with flexion of the knee, and no attempt being made to bring the fragments either into apposition or even very near together. In the rare eases in whieh the fragments are kept in eontact and in which a bony union is obtained between some portions of their surfaces, this union is always more brittle than the original bone, and is not to be relied upon under eonditions of normal aetivity ; while even a very short ligamentous union is deeidedly inferior to a longer one from the point of view of its eventual utility. As soon as the plaster is applied, the patient should get up and walk about, the plaster being renewed as it beeomes loose. It forms a sort of artifieial lower attaehment for the muscles and effeetually eheeks their undue eontraetion. With the aid of a stiek, there will be no diffieulty in at once aceomplishing suffieient movements of the knee joint to carry the foot over obstacles, and power and freedom will in-

crease day by day. The extent of separation between the fragments will be greater in some cases than in others, but this is a matter of very secondary importance, and a good and useful limb will be preserved in all. If the fracture be treated in the old way, by restraint of any kind which prevents free movement, the muscles will undergo wasting, and can only be restored to full usefulness by the careful conduct of systematic exercises when the union, which at best will be only ligamentous, has become complete.

In fractures of either tibia or fibula alone, a poro-plastic splint only should be applied, and removed daily for the purpose of rubbing, and the patient may from the first go about on crutches and perform designed movements of the ankle and toes when lying in bed. If both bones are fractured, Cline's splints should be applied and the knee flexed over a pillow, or on a support swung from a cradle, to relax the tendo Achillis. All rigid apparatus, such as a plaster of Paris splint or a firm starched bandage, is to be condemned, as placing difficulties in the way of movements,

and as thus sacrificing the muscles to the bones. The fracture being duly supported by plaster, the splints should be removed for the daily rubbing and daily exercises, and reapplied when these are over. In fracture of the shafts of the bones, voluntary movements of the ankle should be enjoined from the first; but in Pott's fracture the movements should be confined to the toes until the formation of callus has made some progress, and only then should the ankle be allowed to participate in them. It is perhaps hardly necessary to repeat that by the word "movements" I do not mean those which are effected by an attendant, but only those which are effected by the patient himself, by the natural exercise of the locomotive apparatus which it should be one of the chief objects of the surgeon to maintain in its integrity. After fractures of both bones of the leg, crutches may be given after the expiration of three or four weeks, the first endeavours at walking being limited to barely touching the ground with the foot of the affected side, and progress being made, in the usual manner, as strength returns and as confidence is gained.

CHAPTER V.

INDIVIDUAL DISLOCATIONS.

In addition to the general principles already laid down, in accordance with which all dislocations should be reduced by dexterity and not by force, the muscles, as a rule, being first brought into an unresisting condition by chloroform or the A.C.E. mixture; all swelling or effused blood being gently squeezed away or brought to absorption by daily rubbing, without any apprehension of "inflammation" as a sequel or consequence of pain; and the subsequent production of stiffness or muscular wasting guarded against by sufficiently early movement of the affected joint in directions not calculated to bring about return of the displacement, and under the protection of manual or other support

while the movements are being performed, it may be well to make mention of the particular methods by which, in the dislocations of the shoulder and hip respectively, these principles may best and most completely be brought to application in practice.

In dislocation of the shoulder, the only movements of limited range which involve risk of recurrence of the displacement are those in which the arm is raised from the side, and the head of the bone projected against the inner and inferior portion of the capsular ligament; and it is therefore in these directions that movement must be curtailed. In order to avoid them during dressing and undressing, the shirt should be opened in front, and the shirt sleeve and coat sleeve on the affected side should be ripped open and furnished with strings, as already advised for fractures of the humerus. During the first rubbing, immediately after reduction, the limb may be effectively supported and restrained by the position of the patient and by the hand of the attendant; but, as soon as the rubbing is com-

pleted, an ordinary strip of Mead's adhesive plaster, about twelve inches long by two wide, should be doubled upon itself transversely, and an angular piece about two inches long cut off from each side of the fold, so as to leave a narrow central portion, gradually sloping off to the full width. On this narrow portion a globular pad of cotton wool should be placed, and carried well up into the axilla; the ends of the plaster being brought firmly up over the shoulder and made to cross and adhere over the acromion process. The fore-arm should be carried in a sling, so as to take off its weight from the more or less bruised and strained muscles of the shoulder, and a little pendulum-like play of the suspended arm may almost from the first be permitted. As the swelling and tenderness of the shoulder region subside under the influence of daily rubbing, the arm may be taken out of the sling and extended, the pendulum movements being at the same time increased in range, and flexion and extension of the elbow being performed while the humerus

still hangs down, and is supported by contact of the inner condyle with the side of the body. As strength is gained, the middle portion of the deltoid may be gradually suffered to come into play, and the rate of progress must be determined by the general state of the muscles and of the patient. It is better to sacrifice a little time in order to bring about complete restoration, than to dismiss the patient in a condition in which there is liability to recurrence of the displacement on any sudden or unusual movement of the arm.

After dislocation of the hip, a period of rest in bed is imperatively necessary. The patient should be placed upon a rather firm mattress, at first lying upon the back; and during the first four days the rubber should be instructed not to move the limb. Whenever any movement of the body is necessary, as for the relief of the bowels or bladder, the administration of an enema, or the passage of a catheter, the knees should be fastened together by a bandage, not sufficiently tight to be irksome, but so

that the uninjured limb may act as a splint to the injured one, and may prevent the recurrence of displacement. After four days, a broad band of webbing of sufficient length should be fastened by its ends to the foot of the bedstead, and the patient, with his knees loosely bandaged together, and with the soles of his feet pressing against the bedstead, should be directed to grasp the centre of the webbing band firmly, and, by its assistance, slowly to raise himself to a sitting posture, thus causing the pelvis to rotate upon the femora. He should hold himself up in this way for about three minutes, and then quietly lie down again, and should repeat this movement several times in the day. At first, it will almost certainly be attended by some pain, but this need excite no apprehension, and should on no account be permitted to interfere with perseverance in movement. The groundless fear that pain may be a precursor of "inflammation" is a delusion which has been responsible for the production of more cripples than all the accidents to which flesh

is heir could have produced without its assistance.

The position upon the back soon becomes tiresome, and would interfere with sleep if it were too long maintained. After the first day or two, the patient may turn upon either side, first, of course, upon the uninjured one, but during the first movements of this kind the knees should again be bound together, and, when a comfortable position is obtained, pads of wool, or small inflated bags of india-rubber, should be placed between the knees and ankles in order to protect them from pressure which would soon become painful. In the position on the side the patient will soon begin, almost unconsciously, to make slight movements of flexion and extension both of the knee and of the hip, and these, even if they be arrested by pain at first, should be more and more encouraged as the days go on. It is hardly necessary to say that the first attempts at bearing weight upon the foot should be made with extreme care, and with the assistance of crutches, which may be

laid aside as soon as experience has proved that the limb itself may be trusted, or, in other words, that the muscles are capable of retaining it in any desired position of flexion or extension.

CHAPTER VI.

SPRAINS.

The word "sprain" is commonly employed to indicate a condition in which the movement of some articulation has been carried, by external force, farther than is usual in some particular direction, and in which the structures by which such excess of movement is usually restrained have been more or less stretched or lacerated; adjacent or contained blood-vessels sometimes participating in the laceration. We have already seen that the advance guard of the inhibitory structures, so to speak, is furnished by the muscles antagonistic to the movement which has been carried to excess, as by adductor muscles in the case of abduction, or flexors in the case of extension; and it

is chiefly when this advance guard is surprised, or taken unprepared, that severe sprains are produced. In any voluntary attempt to extend the hand, for example, it will not only be found that the flexor muscles soon become tense and resist further movement, but also that their resistance will be in a high degree effective. The palm of the hand, by their assistance, is able to exert considerable steady pressure, or to resist a considerable sudden shock for which it is prepared; while a similar shock occurring when the flexors were unbraced or unprepared, as in an accidental fall, would force back the hand to extreme extension, and would be said to sprain the wrist. The extent or degree of injury inflicted would vary with the circumstances of each case, but might easily amount to laceration of muscular fibre, of tendon, or even of ligament, complicated by an uncertain amount of hæmorrhage among the surrounding tissues. Such an injury is usually attended by acute and sickening pain, followed by rapid swelling of the neighbourhood of the

joint involved, and by complete incapacity to exercise it in the ordinary manner.

A very common form of sprain is sprained ankle, an injury which is often sustained in coming down stairs carelessly. An advanced foot first touches the step below by its outer edge, the peroneal muscles are relaxed, or at least unbraced, and the weight of the body forces the foot inwards.

In the surgery of the last generation, a sprained ankle was justly regarded as a more serious injury than a broken leg, and as one that often involved a longer duration of incapacity and a less complete ultimate recovery. The treatment was usually limited to the application of leeches and of hot fomentations, and to such rest of the injured part as would not only permit, but would even promote, considerable wasting of muscles, and the organisation of effused lymph into bands or adhesions permanently restrictive of movement. Complete and comparatively early recovery may be brought about by methods almost diametrically opposed to those which were once pursued.

If a case of sprained ankle be seen immediately on receipt of the injury, and before swelling of the soft parts around the joint has occurred, the only treatment necessary is the application of strapping, by which swelling will be prevented, and encouragement to move and use the limb as if nothing had befallen it. If it be not seen until a somewhat later period, even not until the next day, and although some swelling has occurred, it may still be strapped and used at once. In such a case, the plaster will be loosened in twenty-four hours and must be re-applied, as the swelling will by that time have been reduced by the combined effects of muscular action and of external support. As soon as adequate support is given, the patient will find that he can not only put down his foot, but that he can bear weight upon it; and the more determinately it is employed, the more speedily will its restoration to full usefulness be accomplished.

In order to strap an ankle, or an articulation generally, with the purpose of enabling it to continue in movement, the plaster em-

ployed must be of a less adhesive and less irritating character than Mead's, and that which I use for this purpose is prepared by Mr. Tomlinson of Lower Seymour Street, and is spread upon very fine strong linen. The strips for the ankle should be eighteen inches in length, and about two inches wide. The leg should rest on a horizontal bar, with the ankle-joint in a position of complete flexion. The middle of the first strip should be applied to the sole of the foot, in front of the heel, and the two ends should be carried upwards over the tarsus to cross in front and terminate over the ankle. The middle of the second strip should be placed at the back of the ankle joint, and the ends brought down over the foot to cross in front; thus partially covering the first strip, and making a figure of eight. The third strip should reinforce the second, and be placed a little below it, the ends crossing over the instep, a notch being first cut out of the lower margin of the strip at its centre, to remove any impediment to upward movement of the heel. A fourth strip should

be placed above and overlapping the second; and then all four should be retained in accurate position by the application outside them of one or two narrow strips of Mead's more adhesive plaster, used merely as a retaining agent. The original strips should not be drawn tight, but applied smoothly to the actual contour of the skin, great care being taken that no one of them is tighter or slacker than the rest; and the general result is to inclose the joint in a case which offers no impediment to its mobility, but which places an insuperable obstacle in the way of swelling. The patient walks about, and the action of his muscles upon the veins not only soon squeezes away any small amount of obstruction to the circulation, or any effusion which may have begun to find its way among the tissues, but the movements of the articular surfaces upon one another exert the same effect upon any effusion into the joint cavity, which is too deeply situate and too protected to be influenced by rubbing. For this reason, whenever the stage is reached at which rubbing is desirable, the rubber

should be careful to flex and extend the joint in the course of his manipulations.

Unfortunately, the opportunity for treatment of this kind is seldom afforded, and the surgeon usually does not see the patient until some time has elapsed, and until swelling of a pronounced character has already occurred. The patient will usually be in bed, the ankle already considerably swollen, and almost certainly enveloped, under the guidance of domestic medicine, in a thick layer of flannels wrung out of hot water, or out of that sovereign remedy of our grandmothers, a hot concoction of camomile flowers and poppy capsules. It may even be difficult to ascertain whether or not a malleolus has been fractured.

In such circumstances, the first indication is to reduce the swelling by careful rubbing, conducted in the manner already described, that is to say by commencing near the proximal boundary of the swelling, and rubbing always in a direction towards the trunk, commencing the impulse of the hand farther and farther back as the natural

mechanical effect is produced, and the retarded blood passes onward upon its natural course. Three or even four days, with two rubbings each day, may be so employed; and during the whole of this time the patient may remain in bed, and may abstain from voluntary effort. The sole value of leeches, in the hands of the practitioners of a bygone time, was that they gave exit to a portion of the effused blood and serum, and thus to some extent assisted in the re-establishment of the local circulation; but this may be so effectively accomplished by rubbing alone that there can no longer be any occasion to deprive the patient of blood which may be preserved.

Under the influence of careful and well-directed rubbing, the swelling will soon undergo marked diminution; and, as soon as this is apparent, the ankle must be strapped in the manner above described, so that the plaster will accurately fit the circumference of the still somewhat distended skin, but not so as to exert any actual compression while the limb is at rest. As soon as

the plaster is applied, voluntary movements of the joint must be commenced; and the action of the muscles in making them, being unable to produce any yielding of the plaster, will as usual compress the veins and promote the flow of the blood current, or the absorption or removal of effused material. The patient should at once rise from bed and be instructed to bear some weight upon the limb, aided at first, if need be, by the hands of attendants, by the back of a chair, or by a walking stick. The essential matters are that he should learn by experience that he is less severely injured than he is usually inclined to suppose, and that he should be made to understand that his road to recovery will be by way of action and not by way of passivity. These facts once mastered, his progress will be rapid. The daily rubbings should be continued through the plaster, and this should be removed and replaced as often as it is rendered loose by the continued subsidence of the remaining swelling.

The condition of the swelling, when once the plaster has been applied, will enable the

surgeon to form a correct judgment as to the manner in which his directions to perform voluntary movements have been carried out. If the affected joint has been kept at rest, the plaster will remain as tight as when it was put on, and no improvement will have been effected. Perseverance in movement will always diminish the swelling, and, consequently, will always loosen the plaster. If the plaster be found to retain its original accuracy of fit, the surgeon may be sure that there has been no effective movement, and in such case he should not leave the patient until he has seen him stand fairly and firmly upon the limb and make a few steps to and fro. Any pain which such proceedings may produce must be entirely disregarded. It will be less on the next occasion, and still less on the next but one; and the patient must be assured that, beyond the slight inconvenience of bearing it, it is of no consequence at all, and that, if he allows himself to give way to, or to be discouraged by it, he will by so much retard his recovery in point of

time, and prejudice it in point of completeness.

As an indication of the extent of the injury, the amount of swelling is unimportant; and the cases in which there is much swelling are often those which make the best and most rapid recoveries. A bad type of case, from this point of view, is one in which there is but little swelling, with pain limited to a small area. As patients do not die of such injuries, and as there is therefore no opportunity of ascertaining their exact character, the opinion formed on this point must be to a considerable extent conjectural; but I am inclined to think that, in these somewhat troublesome sprains with small swelling and circumscribed pain, there would often be found, if examination were practicable, some rupture of a few fibres of muscle or tendon at the place where the pain is experienced, but with very moderate strain or injury of the surrounding parts, or of the general structures entering into the composition of the joint. Such a condition does not require any special modification of treat-

ment, save that it brings the case under the category of ordinary muscular rupture rather than of sprain, and calls for the diligent training of the muscles of the limb as a whole, and of the injured ones together with the rest, by methods which will be more fully described when the management of torn muscles comes under consideration.

In sprains of the knee, which occasionally happen, the general principles of treatment are the same as in the case of the ankle. Fear will often be entertained that the swelling around the joint is an effect of inflammation within it; but this fear is generally groundless. The swelling of true synovitis, it must be remembered, evenly distends the whole of the joint cavity, and is attended by a peculiar sense of flotation of the patella when handled, which cannot be mistaken by any who have once had experience of it. The swelling attendant upon sprain will be more or less lumpy and irregular, and may be determined by palpation to be chiefly external to the cavity. It places no impediment in the way either

of rubbing or of movement; and speedily disappears under their influence.

In strapping the knee-joint, it is necessary so to adjust the strips as to afford the required support without interference with movement. For this purpose, the limb should be fully extended, and should rest on a horizontal support, leaving the region of the knee fully accessible. The whole surface of the patella should be covered with a thin layer of cotton wool, only thick enough to prevent the plaster from adhering to the skin. Another thin layer of cotton wool should be made to occupy the popliteal space, and be retained there for the moment by the fingers of the patient. A first strip, two inches in width, of Tomlinson's comparatively non-adhesive and unirritating plaster should then be so applied as to encircle the limb immediately below the joint, the upper edge of the middle portion of the strip just catching the wool, and the ends crossing over the tubercle of the tibia. A second strip should partially overlap the first, a third the second, and so on, until the limb is covered to about three inches

above the patella, when the whole should be secured by narrow strips of Mead's adhesive plaster over all. The patient may at once walk about freely, and will experience no difficulty in flexing or extending the joint; while, as in all other cases, the diminution of swelling will be in strict proportion to the degree of perseverance in movement. By the second day, the plaster ought to be loose; and, if it be not, the surgeon may be assured that the patient has been afraid to move the joint with the necessary freedom, and in that case must spare no pains in order to secure that his injunctions are better attended to in the future.

Next after the ankle and knee, the wrist and the thumb are the parts of the body most liable to be sprained, and they present the ordinary symptoms of pain, swelling, and incapacity. They require no other treatment than that which has been described, namely, abstinence from rest, frequent rubbing (which the patient may do for himself very effectively with the uninjured hand), support from plaster, and a steady coaxing

back of the muscles to resume their natural functions. As long as much swelling continues, the hand and fore-arm may be carried in a sling, in order to obviate the tendency to increased venous congestion which would be produced by suffering the limb to hang at length; and the sling should be so adjusted as constantly to maintain the hand at a higher level than the elbow. It should not, however, be worn too long, on account of its inevitable tendency to restrain movement; although, when discarded in the house, it may still be retained out of doors as a danger signal to passers-by. A sufficient substitute for it may often be afforded by placing the thumb or part of the hand in the opening of the waistcoat.

CHAPTER VII.

LACERATIONS OF MUSCLE.

The injuries which may be included under the general description of "Lacerations of Muscle" are extremely numerous; and, inasmuch as they are generally sustained during the pursuit of some sport requiring active bodily exertion, and as different kinds of exertion involve greater liabilities of injury to this muscle or to that, they have come to be commonly called after the sports which frequently occasion them. Thus we have "Lawn Tennis Leg," "Rider's Strain," "Cricket Shoulder and Thigh," "Bowler's Side," and a multitude of similar designations, all of them unpleasantly familiar to large sections of the athletic and sporting communities.

So long ago as in 1884, I communicated to the *Lancet*, and afterwards published separately, a paper on "Lawn Tennis Leg," and a reprint of the essential portions of this paper will, I am inclined to think, furnish a suitable introduction to what I have now to say upon the subject of the class of injuries to which "Lawn Tennis Leg" belongs. It will also serve to show that the views I am about to put forth have already stood the test of an experience of eighteen years' duration.

"The great popularity of lawn tennis," I wrote in 1884, "has given the name of 'lawn tennis leg' to an accident which has long been known to surgeons, but which the particular kind of effort required by the game has of late years rendered much more frequent than heretofore. It consists in the rupture of some portion of the muscular or tendinous structure of the calf."

"Several years ago, when writing for the *Lancet* some papers on so-called 'bone-setting,' papers which were afterwards republished in a volume, my attention had

already been called to the very protracted disability by which this accident was sometimes followed when treated in the ordinary way. The Hon. Spencer Ponsonby Fane kindly furnished me, for the work in question, with the particulars of an accident of the kind which happened to himself in November, 1864, and by which he was crippled until June, 1866, a period of nineteen months. Mr. Fane then came under the care of Mr. Hutton, who told him that his 'ankle was out,' and who performed an operation for the purpose of 'putting it in.' This operation immediately cured his lameness; but when the details first came to my knowledge, I was unable to explain what had occurred. By the light of subsequent experience I was led to believe that the elevation of the heel and extension of the foot, which followed the injury, had caused the weight of the body to be thrown upon the cuneiform bones, thus producing irritation which led to the formation of adhesions, and that these adhesions were broken through when the imaginary dislocation was reduced.

However this may be, it is certain that the patient was cured. I need hardly say that the duration of disability in Mr. Fane's case was exceptional; but every surgeon knows that weeks, or even months, may elapse before recovery from a similar injury is complete. I was led by this consideration to adopt a method of treatment by which I hoped to obtain better results; and it has been so successful in my hands that, after a large experience of its efficacy, I am desirous to make it known to the profession. It is based on two essential points; namely, adequate support for the structures of the calf, coupled with immediate and uninterrupted use of the limb."

"As soon as possible after the occurrence of the rupture, the patient should be placed upon a sofa, with his injured leg raised above the level of his head, and should be kept in this position for five minutes. This is an important preliminary, because the position alone will be sufficient to empty the limb of superfluous blood, and thus to reduce the swelling which is commonly present. A calf

which is much enlarged, and very hard, will frequently return to its natural dimensions within the time specified; and the patient will at once obtain relief from the oftentimes distressing feeling of tension. Moreover, if the elevation of the limb be neglected, the plaster next to be described will soon be loosened by the subsidence of swelling, and will require to be replaced within a few hours. After a sufficient period of elevation, and while the leg is still raised, strips of adhesive plaster, each an inch and a half in width, and of length adapted to the size of the limb, should be applied from two inches above the ankle joint to above the thickest part of the calf, somewhat as strapping is applied in the treatment of chronic ulcers of the leg. (In re-writing this passage at the present time, I should be careful to point out the necessity for leaving the first and last strips of plaster a little looser than the others, so that the pressure of their edges may not impede the circulation.) When the plaster is well adjusted, and the limb is used, its movements disperse the effusion of blood or lymph, and

restore the natural flow of the circulation; while at the same time the plaster holds all the muscular and tendinous structures firmly together, and practically converts the sound portions into a splint for those which are torn. As soon as the plaster is applied, the patient should be directed to walk about the room and to place the heel firmly, or at least fully, on the ground at each step. For the first dozen steps he will probably hesitate, and will maintain more or less of the limp with which he entered; but after a short time, finding that his pain is diminished, or possibly removed, he will gain confidence, and will walk with a pride in his own performance which is very interesting to witness. Until this point is reached, he should not be suffered to depart; for, if he does not walk properly before he leaves the surgeon, he will hesitate still more when alone, and will be likely to return to the ungainly progression which he exhibited at the commencement of the interview. Success in walking, in the first instance, will depend largely upon the temperament of the injured person. A

resolute man, who believes in his doctor, will walk at once, while a more timid patient will require coaxing and urging. The chief trouble will be with the sceptical man, who has his own 'views' about the injury, and who will express them in such questions as, 'Well, but do you not think there is a risk of inflaming my leg?' 'Shall I not make the internal wound larger?' and so forth. With reasonable care neither to jerk the leg nor to twist the ankle on uneven ground, the patient, as soon as the plaster is applied, may walk about as usual. By the second day the plaster will be somewhat loose (the more certainly, the more the injunction to walk has been complied with), and the patient will say that he is not quite so comfortable as before, and is less inclined to trust his leg. The strapping should be re-applied, and he will at once feel more secure and better able to walk. Four days may elapse before the next strapping, which may be left untouched for a week, but the application should be continued at intervals until the patient is quite convinced of his ability to

do without it. On the first occasion very little pressure is desirable, and mere laying on of the plaster will be sufficient. Subsequent strappings should be tighter, but never so tight as to produce a sense of unpleasant constriction. The amount of walking should be increased daily, and after the third day the patient should go up and down stairs freely in the usual manner. Until then, his ascents and descents may be infantine.

"The above described method of treatment is more successful with, and as a rule is more necessary for, the old or elderly than the young. With the latter, for obvious reasons, the accident is of rare occurrence. When it does occur, the sufferer is eager to get back to his games. He makes light of his pain, has no fear of 'inflammation,' covertly uses his limb, even in defiance of medical orders; and, as his cure is rapid under any treatment, he is usually believed by his surgeon to have sustained only a slight tear. The elderly man, on the other hand, is probably inclined to think that he has been foolish at his time of life, and with his

muscles out of training, to engage in a game requiring active exertion. He regards the accident as a lesson in prudence, is fully alive to the value of a sound limb, and sets himself to nurse the injury, with the idea of obviating a wholly imaginary danger of inflammation, or of retarded union of the ruptured parts. By strapping and compulsory exercise he is, in fact, protected against himself. In addition to the rapid cure which it effects, to the prevention of loss of health from want of exercise, and of loss of other kinds through absence from business or occupation, my method has the further advantage of diminishing the liability to recurrence of the accident. The prolonged rest and raised heel, which have generally been enforced in such cases, have a tendency to produce contraction, or a cramped or shortened condition, of the whole of the muscles of the calf, and thus to permit the torn fibres, when united, to be shorter than those around them. At the termination of a case treated in this manner, when absence of pain indicates cure, the patient is able to walk with comfort on

even ground, but has acquired the trick of doing so with an almost imperceptible degree of flexion of the leg. When called upon for any extra exertion, he is apt to be reminded of his old trouble by a sensation of tearing, or an actual tear, at the seat of the former rupture. This sensation may arise from simple stretching of the cramped muscles, and is then only transitory; but sometimes, from perfect extension being suddenly attained, the contracted portions are compelled to bear the entire strain of the movement, and actual rupture may be the result. In either case the pain is looked upon as evidence of a recurrence of the accident, and a further period of rest is enjoined. All this may be avoided by insisting from the outset that the heel shall be placed fairly upon the ground whenever exercise is taken."

"The foregoing observations are founded upon the experience of the last fourteen years (*i.e.* 1870 to 1884), and upon a large number of cases; but this year (1884), among many others, I had what I may fairly call a typical example of the injury in the

person of Dr. W. G. Grace, the justly celebrated cricketer. He came to me on the 13th of June, having had the characteristic feeling of having been smartly struck on the calf on the previous evening, while playing at Lord's. He was compelled to discontinue his innings, having made sixty runs. He limped into my room, expressing the opinion that 'he was done for for the season.' On passing a finger down his calf a distinct sulcus could be felt, and his impression was that 'he dare not put his heel to the ground to save his life.' I strapped up the leg and he walked away, putting his heel fairly to the ground. The next morning he continued his innings, having someone to run for him, and he added twenty-four runs to his over-night score. He did not cease playing cricket, and an extract from a letter from him, dated July 13th, will finish what I have to say about his case: 'You will be glad to hear that my leg has been improving ever since, and is, in fact, well. The accident happened at Lord's on June 12th, and I consulted you the following

morning and found immediate relief from your treatment. You strapped it up from time to time, the last time on June 26th, on which day I played at the Oval against the Australians, and ran for myself 107 runs. My leg was no worse after this, and has been improving every day. I felt myself quite well at Manchester on July 10th, so my leg was cured under the month. I never rested my leg a single day.'

"The more speedily the strapping is applied after the injury the better will be the result, a point which is well illustrated by the following case: I was playing lawn-tennis with a friend whose weight is fifteen stone. I served a ball to him, and he ran forward to take it, but missed it, and then stood still on one leg, like a large bird roosting, gazing round the court. Seeing him remain in this position, I asked what he was looking for. His reply told the whole story: 'Some one threw a stone or a ball at me, and hit me on the calf; and, by Jove, it hurts.' He went home with me, I strapped up his leg, and in three weeks I had the

pleasure of playing three 'sets' with him. He had all his customary activity, and, like Dr. Grace, he had not laid up for a single day."

I have reprinted the whole of the foregoing paper, not only because the principles on which it rests are of universal application to injuries of the class with which it deals, whether occurring in the calf of the leg or in any other region of the body, and not only because it indicates the length of time during which these principles have been brought into daily operation in my practice, but also because it affords me an opportunity of expressing my dissent from the teaching of Mr. Mansell Moullin, as contained in a little book on *Sprains*, in which the paper itself is largely quoted. He tells his readers, with reference to "lawn-tennis leg," that he is strongly of opinion that, in the majority of cases, the real cause (I presume he means of the symptoms) "is to be found in connection with the deep-seated veins that lie between the muscles and form large and often varicose plexuses. The size

and importance of these veins are scarcely sufficiently appreciated. They often form large tumours lying between the deep and superficial muscles; they are frequently the seat of inflammation in connection with gout; in some places they become blocked by coagula, which subsequently undergoes various forms of degeneration; in others their walls become thinned and softened; they are subject to the greatest variations in pressure, and if there is the least strain rupture is exceedingly easy. If this takes place there is at once a large extravasation of blood, and all the characteristic symptoms follow; there is sudden acute pain; the muscles are kept in a state of spasmodic contraction; œdema sets in, especially if the limb is allowed to hang down; the blood soaks down behind the malleoli, especially the inner one, leading to deep discoloration, and if the part is kept at rest, and means are not taken at once to promote the absorption of the extravasation, the surrounding structures become bound together by the effusion that follows, and free use of the muscle is im-

possible. I have known rupture occur in similar fashion in other parts of the body, in the thigh, for example, and in the palm of the hand, and lead to precisely the same results."

"*These cases*," continues Mr. Mansell Moullin, and I give his exact words because it does not seem quite clear what antecedent is in his mind or to what "cases" he refers, "if treated as they should be, invariably get well within a few days; but the treatment is diametrically opposed to that which is most suitable when a muscle is torn. When this occurs everything should be done to bring and to keep together the broken ends, so that they may unite as speedily as possible; the limb should be kept at rest; a splint should be applied, and no strain of any kind allowed to fall upon the injured part until it is thoroughly repaired. If this is tried in the case of lawn-tennis leg, it produces the worst possible result; in a week or ten days the patient gets up on crutches, or, if he is fortunate, with a crutch and a stick; the foot is held in a position of

extreme eversion; the knee and ankle are kept absolutely rigid; the limb is swung round when walking as if it were made of wood, and it is many weeks before full action is regained.

"On the other hand, exactly the opposite method, that which is adopted when a varicose subcutaneous vein gives way, answers here perfectly." At this point, that is, in describing treatment, Mr. Mansell Moullin quotes nearly two pages of my paper, partly with and partly without inverted commas, and concludes by saying: "I would only add to this that each time the strapping is changed the limb must be rubbed and kneaded to prevent stiffness following, and afterwards, when it is left off, the same treatment should be kept up until the patient feels that he can trust his leg as implicitly as he did before it was hurt. Not unfrequently it is some little time before the muscles recover."

My quotations are sufficient to furnish me with some approach to an excuse if I have been so unfortunate as to misapprehend Mr.

Mansell Moullin's meaning, which, so far as it seems plain to me, I will endeavour to set forth. I understand him to maintain that "lawn-tennis leg," in the "vast majority of cases," is not due to any rupture of some portion of the muscular or tendinous structure of the calf, but solely to a rupture of some of the veins entering into the composition of a large plexus situate between the superficial and deep muscles; but at the same time he seems to admit, at least by implication, that it may be due to muscular or tendinous rupture in the residual minority, and he discusses the possibility of the plantaris being the structure which has given way. He tells us that the treatment to be pursued in the case of rupture of a vein or veins is diametrically opposed to that which should be pursued when a muscle is torn; but he gives us no criterion by which one form of injury can be distinguished from the other. In the cases which he assumes to be due to the rupture of a vein, that is to say, in "the vast majority," he gives no other instructions for treatment than by simply re-

printing those which I had published ten years previously for the treatment of ruptured muscular fibre, with the additional suggestion of a "rubbing or kneading to prevent stiffness" each time the plaster is changed; while, for cases which he assumes to be due to rupture of a muscle, or possibly of its tendon, he prescribes rest, a splint, and that no strain of any kind should be allowed to fall upon the injured part until it is thoroughly repaired.

Mr. Mansell Moullin admits that the "usual" explanation of the common form of accident is that it is the result of the rupture of an exceedingly small muscle, known as the plantaris, situate in the substance of the calf; and he quotes me as considering that it is the result of the rupture of some portion of the muscular or tendinous structure of the calf, "without specifying it more particularly." He also admits that my explanation may be correct in those cases (as, for example, in that of Dr. Grace), in which a depression can be felt with the finger. Now it is manifest that, inasmuch as the

injury is never fatal, no one can pronounee authoritatively as to its preeise nature; but the frequent presence of a manifest depression shows that it must often depend upon a rupture of some of the fibrous struetures of the calf, and also that this rupture eannot be limited to the plantaris muscle or its tendon, inasmuch as these are too small, and too deeply seated, to display in this manner any injury whieh they may reeeive. My own opinion is that it is usually a rupture of a few fibres of one of the larger museles, and that it may oeeur sometimes in one of them and sometimes in the other; a manifest depression pointing to the gastroenemius as the seat of injury, and the absenee of a depression affording reason to believe that the torn fibres are in the soleus, and that the break in their eontinuity is eovered and eoneealed by the mass of tissue superfieial to them. Mr. Mansell Moullin's hypothesis, that the injury in the vast majority of eases is rupture of a vein in an intermuseular plexus, appears to me to be absolutely untenable. The only evidenee in support of it

is the occasional hæmorrhagic discoloration of the surface, which may be fully accounted for under the supposition that a vein lying within the fibres of the muscle may have been torn by the sudden rebound incidental to their rupture when in a state of complete contraction. The rupture by muscular effort of any considerable vein, especially of a varicose vein entering into the composition of an intermuscular plexus, would be something approaching to a physical impossibility; and, if it were effected, the amount of consequent bleeding would probably be greatly in excess of anything that is commonly seen in such cases, so far as they have fallen under my observation.

Mr. Mansell Moullin recognises the occurrence of the depression as indicating the probability of a muscular rupture, and he tells us that a muscular rupture should not be treated as I have advised, but by complete rest and the application of a splint, and that no strain of any kind should be allowed to fall upon the injured part until it is thoroughly repaired. In other words,

he would act, as some would-be logicians argue, in a vicious circle. "No strain of any kind" is to be put upon the limb until it is "thoroughly repaired," although it would be difficult to devise any other test of the thoroughness of repair than that which is afforded by capacity to bear a strain. On Mr. Mansell Moullin's own showing, the accident to Dr. Grace, which was attended by a distinct depression, was certainly an example of ruptured muscle, whatever the "vast majority" may be; and it is curious to consider what would have been Dr. Grace's fate if he had been treated for ruptured fibres in what Mr. Mansell Moullin conceives to be the orthodox manner. As for the suggestion that in ordinary cases there is any advantage in rubbing or kneading at the times when the plaster is renewed, it appears to me to be based upon an entire misconception of the fundamental character of the treatment, and of the principle on which it rests. The essential thing is the continued movement of the injured part, and the plaster

is but an accessory without which this movement would be impracticable. If movement be perseveringly practised, there is neither risk of stiffness nor benefit to be derived from rubbing; and, if rest be permitted, no amount of rubbing when the plaster is renewed will prevent stiffness from occurring. I need hardly add that if the "Tendo Achillis" be ruptured, rest will be imperative.

One of the most common forms of an accident strictly analogous to lawn-tennis leg is that commonly known as "rider's strain," which frequently occurs during hunting, and is seen in various degrees of severity. It often arises from a sudden lateral swerve on the part of the horse, which causes the rider to preserve his balance by a sudden contraction of the adductor muscles of one leg, which are thus called upon for a violent effort for which they are unprepared. For example, in rising at a fence a horse for some reason swerves to the right; and the rider, whose muscles were in a state of preparation for a merely forward movement,

would fail to follow the swerve, and would fall to the left, unless he secured himself by a sudden and violent effort of the adductors of the right thigh, with the result that some of their fibres may be either torn or stretched. In cases where a horse pecks badly on landing, it may often happen that both sides may be affected; and, when the rider has suffered on a former occasion, the mere effort of sitting during a jump may be quite sufficient to reproduce some symptoms of the injury, which may vary in its extent from a slight strain to a complete rupture of one of the adductors. The adductor longus is usually the muscle chiefly concerned, but the whole group may be participators in the injury, which usually occurs either at the pelvic attachment or in the body of the muscle. The pain is often described as "sickening"; and, although the patient may still be able to balance himself upon a horse, any attempt on his part to grip the saddle will be defeated by the pain which it occasions.

On examination, the inner aspect of the

thigh will be found swollen and painful; and, when the rupture has occurred in the body of the muscle, a small sulcus will often be discovered at the seat of pain. When any portion of the muscle has been torn from its pelvic attachment, the pain often extends to the margin of the anus, and is of a darting character, whilst the chief seat of tenderness will be found between the attachment of the adductor longus and the perineum. There may be extensive ecchymosis, often visible above Poupart's ligament as well as in the thigh itself, and showing that the abdominal muscles have also been affected.

The usual routine treatment for "rider's strain" has been an evaporating lotion and rest, the latter prolonged for an indefinite period. When riding is recommenced, the patient is usually advised to wear some kind of apparatus, of which dozens have been contrived by different makers. The general effect is to produce a combination of wasting and of chronic spasm of the thigh muscles, productive of a long continued weakness or incapacity of the limb.

In contradistinction to this, the treatment which has the double merit of being speedy and permanently effective is based, as in the case of tennis leg, upon the two words, "Rub and Strap." Precisely as after any other form of injury, the first thing is to promote the venous circulation, and the absorption of any blood or lymph which may have been effused, by orderly friction on the principles already laid down in former pages, commencing near the proximal extremity of the swelling, and rubbing towards the trunk. In some of the cases now under consideration there will be evidence of a considerable amount of internal bleeding, even to the extent of producing not only much discoloration of the skin, but sometimes a visible and tangible lump of considerable magnitude. Such effusions place no difficulty in the way of rubbing, if it be of the gently squeezing character already described, and will soon pass harmlessly away under its influence. In dealing with a mass of effused blood which is more or less globular in outline, its position with regard

to the central circulation may be disregarded, and the rubbing may be directed to the gradual dispersion of its circumferential portions, while the central mass is supported by the thumb of the disengaged hand. A professional rubber will often be usefully guided by a very simple form of instruction; and, in relation to large subcutaneous clots, I have been accustomed to tell my rubbers to attack them as they would attack a plateful of hot pudding with a spoon, that is to say, to go round the edges and approach the centre by degrees. The central support, however, which would be superfluous in the case of the pudding, must always be remembered in the case of the blood clot. In a quite recent case, after about the first three rubbings, the seat of injury should be carefully encircled by strips of plaster, which, as they do not cover a joint, may be of the very adhesive kind (Mead's), and the patient should return to active life. He may at once begin to ride, but for the first few days only on a quiet hack, and with abstinence from

jumping. After about the fifth day the swelling will usually be so far reduced that the plaster will require renewing, and, when this has been done, the patient may recommence jumping, even though it may at first entail a certain amount of discomfort. If the case be not seen until a week or more has elapsed since the injury, the period of rubbing prior to the application of the plaster must be extended, and the commencement of riding or other active exertion must be deferred.

In cases in which it is difficult to obtain the proper renewal of the plaster, the best substitute for it will be furnished by what is known as "Salmon's bandage," which, being lined with india-rubber, is not liable to slip down the limb, and hence does not require the addition of a belt round the waist.

In some instances, the first occurrence of rider's strain, and its treatment by methods which fail to preserve the general integrity of the affected muscle, is followed by so great a liability to the accident that it recurs in some degree at least every hunt-

ing season, and is occasioned by the most trifling causes. In these chronic cases, there is always general atrophy of the muscles of the thigh, combined with contraction of the adductors; the latter often to such a degree that the mere act of separating the thighs is difficult and painful, or even impossible. It may even sometimes be necessary to stretch the adductors under an anæsthetic before curative treatment can be profitably undertaken. In cases of this class it is necessary gradually to restore the function of the affected muscles by graduated exercises, of a kind which will be more fully explained in a subsequent chapter.

It is obvious that many forms of sudden and violent muscular exertion must be liable to produce injuries bearing a family resemblance to the two common ones already described; and I hope to make it also obvious that, in the treatnent of them all, the same principles must be observed, only differing somewhat in their application in accordance with the mechanical conditions of the parts in which they occur. Rubbing

for the dispersal of blood clots or effusion, support by plaster for weakened structures, and systematic movements for the preservation of the activity and efficiency of muscles, comprise nearly all that can be said about them. It may, nevertheless, be expedient to mention some of the injuries of this class which most commonly occur, and which, as results of the movements required by certain games, have become more or less connected with them in popular estimation and nomenclature.

The term *Cricket Thigh* is often employed to denote a rupture of some of the fibres of the rectus or quadriceps extensor femoris, such as may occur in starting for a sprint, and is therefore most frequently met with in connection with cricket, foot-racing, and football. Where the rupture is in the muscle, rubbing, strapping the thigh, and continued use of the limb will lead to speedy recovery; but, if the quadriceps tendon should be entirely torn away from the patella, a period of rest on a back splint must be combined with the rubbing, and

the accident must be generally treated as advised for fracture of the patella.

"*Bowler's Side*" is caused by fast bowling, especially on slippery ground in wet weather. It is a strain or tear of one or both of the oblique muscles of the abdomen, and usually occurs just at the border of the twelfth rib. The injured part is very painful, either in movement or on a deep inspiration, and there is usually some swelling. After rubbing, the side should be strapped with adhesive plaster as for broken rib, from just above the seat of the injury as low as the crest of the ilium. When this has been done, the patient will in two or three days be able to resume bowling with safety and comfort.

"*Cricket Shoulder*" is a strain produced in throwing a ball, and usually means either the rupture of some fibres of the deltoid, near its insertion, or a strain of the long head of the biceps, which is sometimes displaced from its groove. If the injury be treated by rest, and if it be in the deltoid, that muscle will speedily fall into an atrophic

or at least a weakened condition, and the trouble will certainly recur whenever any attempt is made to bring it into energetic action. If the biceps tendon be the part affected, some inflammation is usually excited in the sheath, and this, if treated by rest, may not only extend to the joint, but will in any case be liable to set up adhesions calculated to produce permanent disability. It is only necessary, in either case, to apply rubbing and strapping, and to encourage use of the joint; but, if a case of the kind has been "rested" or neglected, it will be necessary, when the deltoid has borne the stress of the injury, to develop the powers of this muscle by special exercises; or, when the strain has fallen chiefly upon the biceps tendon, to loosen the adhesions under an anæsthetic, as a preliminary to similar treatment.

Sprained Elbow is a condition which may be produced by a variety of active employments of the arm. It often occurs in lawn-tennis from repeated back-handed strokes, or when the strokes are habitually made from the elbow and not through from

the shoulder. It occurs in one or both elbows as a consequence of a faulty swing in golf; or it may be produced by fly-fishing or by wielding a heavy coaching whip. The pain is usually first referred to the outer side of the joint, at the attachments of the supinator longus, and of the extensores carpi radialis longior et brevior; but it is sometimes felt on the inner side near the condyle, and from both situations it is liable to radiate down the fore-arm. There is nearly always some thickening to be felt about the seat of pain, together with some tenderness on pressure; and, in cases of long standing, the muscles of the fore-arm will have undergone a certain amount of wasting, easily discoverable by comparative measurement. When this has occurred special exercises will be indicated; but in all recent cases a cure will be brought about by rubbing over the tender spot, by giving the muscles of the fore-arm support by strapping, and by continuing regular, but not excessive, use of the joint. The plaster should commence about four inches below the elbow, and be carried

up to the joint, the ends of the strips crossing in front of the limb. A curved portion must be cut out of the middle of the last or highest strip, so that it may not interfere with flexion; and the forearm must be so placed as completely to relax its muscles before the plaster is applied. If the strain has been occasioned by anything faulty in the method of play, the manner of making strokes should be reconsidered by the light of experience.

Piano Hand, *Typist's Cramp*, *Writer's Cramp*, are names given to forms of disability of the extensor muscles of the fore-arm produced by excessive use of certain groups of them, with no corresponding exertion of the limb as a whole. Piano Hand is chiefly seen among girl students, the men being probably preserved from it by sports or occupations which promote the nutrition of the neighbouring muscles. The characteristic symptom is the occurrence of pain and cramp in the fore-arm on attempting to play; and the pain is referred to the extensor surface of the fore-arm, and

commonly to the extensor indicis, the extensor communis digitorum, or the extensor minimi digiti. It arises from the continuous and often excessive use of these muscles in the performance of very quick and delicate movements, by which they are rendered irritable and liable to cramp, while the fore-arm as a whole will be found weak and flabby. The patients are often anæmic or neurotic girls, whose general condition requires medical care; but the local affection may be effectively treated by shampooing, and by strapping the wrist to support the muscles; while, at the same time, the patient must persevere with exercises calculated to call into activity the extensors as a whole. Piano practice need not be entirely prohibited, but during the first stage of the treatment should be confined within moderate limits. The same kind of weakness and cramp occurring in typists or in writers must be treated in a similar manner, and the special exercises for the fore-arm will be described hereafter. It must not be forgotten that there are cases

much resembling writer's cramp which may be symptomatic of disturbance of the motor nerves or centres, or that in chronic cases the original over-fatigue of the muscles may have reacted upon the nerves which control them ; but cases in which the only symptoms are pain and cramp when the injurious occupation is commenced, but which subside as soon as it is relinquished, may safely be referred to the irritability of tired and under-nourished muscle, and may be conducted to recovery on the lines above laid down.

"*Dropped Top*" is the familiar term used to describe an accident not uncommon among wicket-keepers, which is occasioned by the ball striking the tip of a finger and flexing it suddenly. The terminal phalanx will be found swollen, semi-flexed, and uncontrollable by the will of the patient. It can be extended by the surgeon, but returns to its former position as soon as it is left alone. It is probable that the sudden flexion by external violence, before the extensor tendon has had time or warning to become relaxed, has torn this tendon from its attachment to

the phalanx, or at least has stretched or loosened it. The best results, and sometimes excellent ones, are obtained by shampooing the injured finger and by strapping it to one of its neighbours to act as a guiding splint; but in many cases the power of complete extension will not be restored. If the finger be put upon an ordinary splint, and kept at rest, the usual consequence is a stiff joint, which, when loosened by the rupture of adhesions, falls hopelessly into a semi-flexed position.

Coccygodynia.—A place, if not exactly among the lacerations of muscle, at least among the strains or disturbances of fibre which may be brought about by exertion or by accident, must be given to the condition which has been called "Coccygodynia," by gynæcologists, and which is described in text-books as a severe pain in the neighbourhood of the coccyx, excited by such actions as defæcation, walking, sitting down, or rising from a recumbent posture. It is manifest that the coccyx itself may be tilted or displaced, or that the muscles inserted

into it may be bruised, lacerated, or over-strained, by many kinds of effort or of accident; in parturition, in falls in a sitting posture, and so forth; and the accidental causes of the affection often happen to women in the hunting field, in whose falls the buttocks are apt to come into sharp contact with the ground. In the case of a woman who falls somewhat obliquely in a sitting posture, one buttock touching the ground before the other, and being suddenly stopped in its descent by this contact, it is remarkable that coccygeal pain will most frequently be felt upon the other side, the muscles of which may scarcely have touched the ground at all, and may almost be described as having missed the support, or the check to their action, which contact with it would have afforded. In such cases the strain often extends to the sacro-iliac ligaments generally. When the impact of a fall is central, the shock is mainly received by the sacrum and the soft parts covering it, and not by the coccyx at all, but this part of the skeleton, and the nerves and muscles of

the vicinity, are all affected by the subsequent swelling, and will all be tender and troublesome for a time. When the patient sits there will be pain, although the pressure does not fall on the coccyx; but in lying on the back there will be no pain, as the weight of the body will then be supported by the glutei. If the coccyx has been tilted forward by the accident, there will always be pain during defæcation; but such pain will be absent if the sacrum be the part on which the stress of the blow has fallen. When a case of injury likely to cause coccygeal pain is seen early, the presence or absence of pain during defæcation is important; and, if it be present, the faulty position of the bone should be redressed. For this purpose, an anæsthetic should be administered, one finger passed into the rectum, and made to engage the bone, while counterpressure externally permits the surgeon easily to correct any displacement. In the absence of pain during defæcation this procedure is not called for; and the only treatment required is such local rubbing as may assist to disperse the swelling, together

with such movements of the parts concerned as may suffice to prevent the formation of adhesions. In cases of some standing, for which various operative procedures have been resorted to, such as complete excision of the coccyx, or the division by a tendon knife of all the structures attached to it, all that is really required is to correct displacement if it should have occurred, and to enforce such muscular action as may restore the integrity of the neighbouring parts. I was once consulted by letter on the case of a lady living in Ireland, who was unable to come to me, and who wrote to say that she could not ride without great pain in the coccygeal region. I advised her to have a small horseshoe-shaped air cushion, with its convexity forward, sewn into the seat of her hunting breeches in such a way that its two arms passed under and supported the tuberosities of the ischia. She did so, and afterwards reported to me that she had immediately ridden and even jumped with perfect comfort, and that in three weeks she was quite well, and able to

dispense with the support. The fact was, that the cushion relieved the tender spot from pressure, and that the movements incidental to riding served the purpose of rubbing, and brought about the absorption or removal of any blood or lymph which had been effused in the neighbourhood of the original injury.

Another affection which hardly admits of being classified, but which often interferes seriously with locomotion, may perhaps be best designated by the name of *metatarsal pain*. It may be described as pain in the sole of the foot at a metatarso-phalangeal joint, and may usually be traced to wearing narrow boots with high heels. In this combination, the toes are squeezed together, while the high heel throws the whole weight of the body upon the front part of the foot. By this action one or more of the metatarsal bones may be pushed below the plane of the sole at their anterior extremities, and may become inflamed and swollen, possibly, as in bunion, with some bursal hypertrophy underlying them. When the boot is removed and the pressure thus relieved, the pain ceases. In

many cases it will be found that the inflammation has caused the formation of adhesions in the affected joint, and that these will require to be loosened by manipulation under an anæsthetic as a preliminary to other treatment. When this has been done, shampooing and a broad-soled boot will as a rule complete the cure; but in some cases the downward tendency of the bone continues, and it is then necessary to wear a felt pad behind the affected joint, both to take off the pressure and gradually to correct the tendency to continued displacement.

"*Bunion.*"—The present fashion of boots is also greatly answerable for an increased prevalence of bunions. The pointed toe of the boot brings about eversion of the great toe; and instead of the share of weight, or the surrounding pressure when the boot is worn, being distributed evenly over the entire toe, both fall mainly on the junction of the phalanx with the metatarsal bone. A corn is formed—this is from time to time removed—possibly the boot is enlarged—ultimately, however, the corn produces inflammation of the bursa, and a bunion is the result.

CHAPTER VIII.

MUSCULAR EXERCISES.

It has been mentioned, in many of the foregoing chapters, that the residual incapacity, so to speak, which may be left behind by various injuries, will usually require for its removal the careful employment of muscular exercises specially designed for the purposes which they are intended to fulfil; and that these exercises, generally speaking, cannot be replaced by others. A healthy person may unquestionably promote not only general muscular development, but also the development of particular sets of muscles, by almost any kind of activity which calls either the whole or a part of the body into exertion; and, for the purposes of what may be called general athleticism, all manner of apparatus and all

manner of schemes of exercise are already before the public, and may be employed according to the taste or fancy of the employer, if not with identical, at least with comparable and fairly equal results. Clubs, dumb-bells, india-rubber bands, all have their uses and their advocates; and many forms of exercise may be accomplished with them all. For the relief of partial disabilities, or of the weakening of certain portions of muscle as the results of injury, it is not too much to say that they all conspicuously fail of attaining the objects for which they are supposed to be required.

A muscle which has suffered, let us say, a laceration of a few of its fibres, and which, in consequence of that laceration, has been permitted to "rest," or, in other words, to undergo wasting for some indefinite period of time, is left in a state of general debility, which is accentuated with reference to some particular direction of movement; that is to say, with regard to any in which the lacerated fibres, if sound, would be called upon to take a prominent part. In many of these

cases, although the injured fibres never reunite by proper muscular substance, the connective tissue sustaining them is probably only stretched, and becomes infiltrated with plastic effusion which gradually passes into a contractile and adherent cicatrix, and exerts painful dragging upon neighbouring parts as soon as its relations with them are disturbed. Let it be assumed that the laceration has occurred to a few fibres of the deltoid, and that the arm has been kept in a passive condition. The power of raising it will be altogether impaired; but it will depend on the position of the lacerated fibres whether the impairment will be more conspicuous in direct raising, or in raising with an inclination backwards or forwards. Whichever it may be, the movement which occasions pain will not only be avoided, but, whenever circumstances call for any approach to it, the stronger portions of the muscle will be thrown on guard, so to speak, for the express purpose of protecting the weaker parts from being employed. An attempt to lift the arm will be productive of a rigid shoulder joint, and the movement will be

converted into one of the scapula or of the trunk. In these circumstances, if the patient be made to grasp a suitable ring or handle, to which is attached a cord running over a pulley fixed above his head, and carrying a light weight, say of two pounds or so, at its other extremity, and is directed to draw up the weight as far as may be convenient and then to let it return gently to its position, doing this again and again, a very different effect will be produced. If the patient commence with his arm raised as high as possible, its descent under the influence of its own gravity, on the mere cessation of the effort to keep it elevated, will suffice to draw up the suspended weight; and, as this sinks to return to its original position, the arm will again be almost unconsciously raised, and the deltoid will be more and more brought into play and exercised, without any effort or strain at which its specially weakened portion can take alarm. This specially weakened portion, indeed, will find itself at work before it is aware, and will be cheated, so to speak, into constantly increasing par-

ticipation in the effort of the muscle as a whole. If the weight were a heavy one, or if an attempt were made to lift a dumb-bell, or a club, no similar effect would be produced; and if the patient were directed to draw down the lower handle of an india-rubber band, this would offer a constantly increasing resistance to its own elongation, and would tend, whenever the downward pull ceased, to take the arm up with a jerk, and to harass the deltoid instead of beguiling it. The principle thus laid down is of universal application in such cases, and a few days will generally suffice to bring the specially weakened portion of the muscle into line with the remainder, and to get rid of any pain which the earlier efforts may have occasioned. When this has been accomplished, the muscle may be exercised more freely and as a whole, and the weights employed may be increased. All that is necessary in the first instance is so to arrange the exercises as to furnish a movement in which the weakest part of the affected muscle must take its share, and to do this in such a

manner that the movement in question is started, and in its course is facilitated, by the descent of the weight which the opposite action has drawn up.

There can be few better illustrations of the operation of this method of treatment, as there are none more frequently presented to observation, than those afforded by cases in which, either by "rider's strain" or by some slip or other accident befalling a pedestrian, the knee is bruised or strained, or the adductor muscles of the thigh are injured, somewhere near their insertion. The usual treatment in such cases is to keep the part at rest until the swelling has disappeared, possibly for some weeks; and, when this object has been attained, the patient is permitted to walk. For the first few days he may get about fairly well with the assistance of a bandage, although suffering some pain; but in a short time he will complain of great weakness, possibly with some return of swelling. He will then often be told that more rest is required, that he must not walk without some stiff support, and

that months may elapse before he is restored to his normal condition. Swelling of the knee is apt to be erroneously regarded as a consequence of synovitis of the joint; although, as a matter of fact, it is always external to the joint, and never presents the uniform distension and the floating patella by which true synovitis is characterised. The truth is, that the original swelling both distends the skin and impairs its elasticity, and that the inaction of the muscles permits the continuance of a certain amount of venous congestion, with the result that the blood ponds or stagnates in the affected parts, and that its more liquid portions are liable to undergo transudation into the tissues around the veins. There will often be considerable pain on any movement which approaches adduction, pain referred to a spot at the inner side of the knee; and the explanation is that such movements are performed by some portions only of the muscles usually concerned in them, and that these portions pull or drag irregularly upon their insertions, this pain being frequently

ascribed to rheumatism or gout having attacked the parts. The cases may go on for months, the patient gradually learning to rely almost entirely upon the sound leg, and finding that in this way he can move about with some freedom. Sooner or later he usually forgets his caution, attempts some sudden or independent movement with the lame leg, and sustains a severe sprain, possibly attended by genuine displacement of a cartilage, a condition which, in the earlier stages of the affection, is very often, but generally very erroneously, supposed to exist. I have sometimes compared the conditions leading to a second accident to an endeavour to drive a strong and a feeble horse in double harness. As long as the former will do the work, and the other is permitted to trot by the side of his companion, all goes well; but, as soon as the strong horse relaxes his efforts, and the weak one is called upon, he fails to respond to the suggestions of his driver.

The condition above described is one which comes under my notice so frequently

that I have adopted for it the designation of "common knee," and use for it in my note-books the still more simple form of "C.K." It will always be found on measurement that the muscles of the thigh are wasted, so that the limb measures an inch or an inch and a half less in circumference than its fellow; but this wasting is seldom conspicuous to the eye of a careless observer, because the rectus has usually been permitted to do some work in the limited rate and method of progression, and may therefore have preserved something of its natural proportions. If, at the same time, the knee be a little swollen, as is usually the case, the contrast afforded by the wasting of the thigh may bring this swelling into prominence; and, until it is exactly tested by measurement, may make it appear much more considerable than it really is. The necessary treatment is to leave the knee entirely alone, but to strap the thigh in the manner already directed, for the purpose of supporting the skin, and of directing upon the veins the action of the muscles as they contract. The

first exercises should be performed by attaching to the ankle a band, from the inner side of which, at the level of the malleolus, a cord passes under a pulley at a little above the level of the floor, ascends some five or six feet, passes over another pulley, and then descends, carrying an appropriate weight. The patient being seated, and the cord taut, he makes a movement of abduction of the leg, drawing the weight up as he does so, and, when he has accomplished what he can in this direction, he allows the action to be reversed, and is assisted to assume a position of adduction by the weight as it descends. In this way the adductor muscles are gently stimulated into renewed activity, the natural range of movement is soon restored, and is accomplished without the pain which previously attended all efforts in this direction. The exercise may soon be varied, and the weight increased, as strength is gained and at the discretion of the surgeon; and, as soon as the thigh is restored to the same measurement as its fellow, the cure may be regarded as complete

It has been mentioned that these cases of "common knee," with their liability to attacks of acute pain near the inner side of the head of the tibia, are sometimes mistaken for displacement of a semilunar cartilage, and also that they sometimes lead to the actual occurrence of such displacement. Whenever I have been consulted about a case of the latter kind, and have come to the conclusion that no treatment short of the fixation or partial removal of the cartilage was likely to be efficacious, I have been accustomed to send the patient to Mr. Herbert Allingham, who has, I believe, done more operations of this kind than any other surgeon; but when I see that the limb has only undergone atrophy from protracted rest, I have advised a course of exercises. The result has constantly been to spare the patient an operation, the muscles soon regaining sufficient strength to take the joint into their safe keeping, and to restrain it from lateral movements. When the muscles are atrophied the patient becomes loose-jointed, and, although the cartilage does not slip from its position, the condyle, either

inner or outer, is liable to nip or bruise it. Mr. Allingham himself so fully recognises the value of the treatment by exercise that he has in many cases declined to operate until it has been fairly tried; sometimes sending the patient to me, sometimes directing the exercises himself. In this way an operation has frequently been avoided; and no time has been lost even when it has eventually become necessary. In such instances the limb has recovered its strength prior to the operation instead of after it had been performed.

It is manifest that, by means of an ankle band or stirrup to which the cord is attached, and by combinations of two or more pulleys, every possible movement of the lower extremities may be performed against the pull of the weight, and reversed with assistance from it as it descends; and that the exercises may be accomplished in either a sitting or a standing posture. The surgeon has first to consider what movement it is that the patient is least able to perform, and to arrange the contrivance in

such a manner that this movement shall be assisted by the weight as it returns to the position from which it has been raised by the antagonistic movement. The same applies to all muscles of the arms and trunk (handles being substituted for the anklets), with the exception of flexion and extension of the hands by the muscles of the fore-arm. For these the best contrivance is a roller, of such diameter that the fingers will close round it comfortably, fixed at a convenient height, and furnished at one end with a ratchet that can be released, and at the other with a cord carrying a weight, and so arranged as to coil round the roller as it is turned. The roller should then be grasped overhand for exercise of the flexors, and underhand for exercise of the extensors, and slowly turned until the weight is completely wound up, when the ratchet may be released and the weight either suffered to run down, or controlled in its descent by muscular effort. It is essential that all the forms of the described apparatus should work smoothly and with a minimum of

friction; and they may all be seen at Benson's gymnasium in Orchard Street, to which it will in most cases be desirable for the patient to resort for his first exercises; although, when he understands the way in which they are to be carried out, and the principles on which they rest, he will usually be able to fit up some domestic contrivance by which anything more elaborate may be replaced.

In certain cases, chiefly those of injured arm, leg, or back, in which for any reason the exercises just described cannot be brought into operation, or sometimes as an adjuvant to them when they are being employed, I have been in the habit of prescribing exercise "in water," that is to say, in a swimming bath. The water buoys up the affected limb, and renders its movements comparatively easy; and, in the case of any injury to or weakness of the back, it entirely relieves the weak part of the weight of the head and shoulders. These "water exercises" are of especial value in cases of rheumatoid arthritis of the hip. They allow of painless voluntary movement to a sufficient

extent to preserve the muscles in condition; and thus, when the disease has run its course, the patient, instead of having the buttock and thigh of the affected side only half the size of those of the other, finds himself in possession of a lower limb capable of sustaining his weight in standing and walking. As most patients suffering from this malady are induced, sooner or later, to undergo treatment at some "water-cure" establishment, I always impress upon them the desirableness of remaining in the swimming bath, kicking about and swimming, as long as the doctor in charge of the institution will allow.

I have now endeavoured to lay down the general principles, and, in relation to the more important cases, the detailed application of the principles, by which the treatment of large classes of injuries should be governed; and it may possibly not be unacceptable to many readers, especially to those whose experience has taught them to turn to the postscript as to the most important part of a letter, if I append

a few last words by way of summary of what has gone before. My main contention, to which all else is subordinate, goes to establish the supreme importance of such early and continued use of injured parts as may serve to prevent the formation of crippling adhesions on the one hand, or the occurrence of muscular wasting on the other. It is by reason of one or both of these conditions having been suffered to become established that injuries, whether fractures, dislocations, or sprains, become sources of long continued disability; and the great principle to be borne constantly in mind, in relation to the prospect of such disability, is that prevention is not only better than cure, but also far easier and more rapid. In order to prevent, it is necessary from the first to move the injured joint or muscle concerned; and in doing this, pain may practically be altogether disregarded. In the conditions under consideration it is neither a danger signal nor a warning, but is merely a natural and inevitable result of certain physical changes in the parts concerned. It differs altogether, alike in character and in the probable issues to

which it points, from the pain which is associated with (for example) tuberculous disease of synovial membrane or of cartilage; and no one possessing ordinary clinical insight could for one moment mistake one variety for the other. The pain incidental to injury is usually dependent upon compression or tension of the local nerves by effusion and consequent swelling; and this swelling is reduced or removed by properly conducted rubbing, which squeezes away the intruding fluid. If a skilled rubber be not available, a good result may be obtained by strapping and perseverance in voluntary movement, which, when the skin is prevented by the support from yielding to the contraction of the muscles, acts in a somewhat similar way to rubbing, and squeezes both the veins and the connective tissue of the part concerned.

Besides causing pain by distension, the presence of swelling impedes or arrests the ordinary venous circulation, so as not only to retain in the vessels blood which is on its way to be re-vitalised by respiration, but also to prevent the arrival of the fresh arterial blood which is necessary for the proper continuance

of nutrition. This arrest of circulation strikes at the root of the conditions required for the maintenance of the muscles in functional activity; and, when combined, as it too often has been, with instructions to abstain from movement, very speedily reduces them to an enfeebled or atrophic condition, from which they can only be recovered by exercises carefully addressed to the particular kind of action in which their weakness is most conspicuous. When this happens, pain of another kind is experienced, pain dependent upon the resentment of weak fibres, or of fibres which have been broken and are connected by contractile tissue, when they are called upon to do the work of healthy ones. Here again the pain must be disregarded, and the weak fibres must be coaxed back to exertion until the consequent stimulus to their nutrition begins to take effect.

The general principle of sustaining muscular nutrition by frictions and exercise will be found to have wider applications than to cases of injury alone. There are forms of paralysis of nerve origin, admitting of recovery, or at least of improvement, as far as the nerves or

nervous centres themselves are concerned, which may easily pass into a permanent or incurable form as a result of muscular degeneration consequent upon disuse; so that, when the nervous energy or nervous conduction is restored, the muscles will no longer respond to the appeal of the will. This often occurs in the slighter degrees of hemiplegia, for which it should be an important part of the treatment to rub the affected leg and arm daily for half an hour. Assuming the attack not to be fatal, the muscular power of the limbs will be preserved, and any partial recovery from the general condition will be greatly promoted by their retained capacity for action. The same applies to infantile paralysis, in which the common injunction to rub the limb is far too often regarded as unimportant. In these cases rubbing should be diligently practised until the child is three or four years old, and should then be followed by gentle exercises for a quarter of an hour daily, with pulleys and the lightest of weights. Unless this be done, it frequently happens that the paralysis of a particular group of muscles is made to condemn

all the muscles of the affected limb to inaction and to consequent atrophy; whereas, under the influence of rubbing and exercises, it will frequently be found that the movements proper to the muscles which are really deprived of their nerve supply will to some extent be done by others in substitution for them, and that a considerable degree of practical usefulness may be preserved in the affected limb.

My own work in the directions above indicated, which extends over more than a quarter of a century, has, of course, been gradually developed from more or less tentative beginnings; and I am pleased to recognise that a somewhat similar trend has of late years been manifest in the practice and writings of many other surgeons. The fact indicates that truth must ultimately prevail over error, when both are tried by the touchstone of experience; and I venture to express the hope that my readers will take their share in the application of this test. I was amused, not long ago, by a remark made to me in consultation with a very plain-spoken country practitioner, to whom I expounded my views as to the

way in which the cure of his patient might be brought about. He said, "That is all very well for you, who can do what you like; but, *in my tin-pot village*, if I were to depart from the methods which the old women of the neighbourhood had been accustomed to witness and to approve, I should be called over the coals in an unsparing manner." The fear of old women, of both sexes, extends far beyond the limits of "tin-pot villages," and has to be reckoned with in the conduct of all professions. But the methods described in the text have been successful in my practice during a period of five-and-twenty years, and in their applications to about as many thousand cases, so that I have long ceased to entertain any doubt either as to their employment in my own hands, or as to my complete title to recommend them strenuously to others. If they ever fail of success, the failure will depend only upon their being timidly or imperfectly carried into practice.

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